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Ibaccon

THE

WORKS

OF

FRANCIS BACON,

BARON VERULAM, VISCOUNT ST. ALBAN, AND LORD HIGH CHANCELLOR OF ENGLAND.

VOLUME THE ELEVENTH.

CONTAINING

SCALA INTELLECTUS.

THE HISTORY OF LIFE AND DEATH,

AND

A Critique on the more Ancient Philosophers.

LONDON:

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SCALA INTELLECTUS:

OR, THE

PROGRESS OF THE UNDERSTANDING

IN

PHILOSOPHICAL ENQUIRIES:

SHEWING, BY

EXAMPLES,

The Method of employing the Materials of the

SYLVA SYLVARUM;

And Illustrating the

RULES AND DIRECTIONS OF THE NOVUM ORGANUM.

FOR BUILDING A

SOUND PHILOSOPHY.

By the Means of

PARTICULAR HISTORIES.

23X295

PREFACE.

THE author appears to have published nothing with a direct and immediate view to the fourth division of his works. The design of that part was to contain a competent set of examples, or models, for working with the mind, in philosophical subjects, according to the genuine laws of induction; intimated, and, in some measure, explained, in the Novum Organum. We are, therefore, to understand the following pieces of Life and Death, &c. not as examples of a genuine induction; but as mixed writings, which deliver matter of natural history, in a method approaching to that of induction; but frequently interrupted by large observations, admonitions, and directions. Indeed it should seem, that the author designed to have digested and improved all the matters collected in his Sylva Sylvarum, after the manner of these examples; in order to facilitate the business of strict induction, that was to follow in the intended fourth

division; the perfecting whereof belonged to the sixth. In the room, therefore, of the intended set of more rigorous inductive histories, are here substituted a somewhat looser kind: of the same general nature, method, and tendency. And perhaps the author might find, that the imperfect state of philosophy in his time, could scarce, to advantage, allow of a more rigorous induction, without launching into mathematical or metaphysical considerations; which would have been deviating from his purpose. At least, he seems to have chose, if not the most strict, yet the most instructive method of inductive history; whereby the succeeding philosophers might be directed how to conduct and prosecute enquiries in the more perfect manner; and gradually proceed to Axioms, and capital rules of practice.

SCALA INTELLECTUS.

INTRODUCTION.*

THEY who have not acquiesced in the doctrines and positions of the ancients, whether from a firmness of mind, as is sometimes the case; or from a levity of temper, which more frequently happens; generally defend their procedure with this argument; that though they relinquish antiquity, yet they produce such things of their own as are perfectly agreeable to sense: and that if other men were not awed by authority, and durst trust to themselves, they would easily come over to this side. But for our own part, we neither offer violence to the senses by contradiction, nor destroy them by abstraction; but have supplied them with a much larger fund of

* The following Introduction is collected from certain scattered fragments in the Scripta, published by Gruter.

matter than others. We would correct their errors by various administrations, enlarge their powers, improve their judgment, condemn their illusions, and by bringing reason into a due frame, confirm, strengthen, and guard them; thus endeavouring to perform what others only profess; and really defend, confirm and improve the senses: the tendency of our whole philosophy being little more than to free and restore them.*

Yet we promise ourselves no great influence upon the belief of men; because our method agrees with none of those that have gone before us; but proceeds quite contrary thereto. For they who before us, being sick of the doctrine of the ancients, applied to sense and experience, as to a thing almost entirely new; have, generally, at first made some enquiries with vigour and resolution, under the conduct of the senses; and seized upon those things which seemed to them of a more general nature: and from such detached parcels of experiments they immediately proceeded to form theories; and thus philosophized by starts, with narrow views; and judged of all things by a few.

This imperfect method of philosophizing is, however, often successful, in gaining credit, from the narrowness of the mind, which is principally

* See the Novum Organum, Part II.

moved by such things as strike and enter it at once; and being desirous of acquiescing in some one thing, either neglects all the rest; or else, in a certain imperceptible manner, supposes that all things else are correspondent to those few which naturally fill and distend the imagination.

We, on the contrary, who desire to introduce not handfuls of experiments, or little detached systems of things; but the whole universe with its works, as formed by the great creator; and aim to pronounce according to the truth and result of things; scarce know which way to turn ourselves, or on what side to solicit our entrance into the mind, and gain a credit to what we are about. For the things we have to offer go deeper than notions; and spread wider than partial experiments. Whence it must necessarily happen, that the greatest part of what we deliver will not satisfy the over-hasty and quick apprehensions of sense; to which some of our doctrines will appear hard and incredible, almost like points of religion. For the senses certainly deceive us; though not when duly rectified and assisted. We therefore enter upon a new way of delivering ourselves, agreeable to the work we have in hand; and proceed, not by disputing, or by producing a few scattered experiments; both which ways might frustrate our end, as our determinations are neither founded upon notions,

nor upon maimed and divided experience: but we use experiments collectively; lead the mind, in a continued chain, to the fountain of things; and set to view the whole process of the understanding, with the advantages and uses to be derived therefrom. Those therefore, who either rest upon arguments, or depend upon a few experiments, or, through a narrowness of mind, submit to authorities, or for want of opportunity, cannot give our works their due perusal, and must not expect to comprehend our meaning.

It would be a difficult task to confute those who will have nothing to be knowable; even though we candidly interpret the expression. For if any one should maintain that true knowledge is the knowledge of causes; and that the knowledge of causes is continually rising and climbing, in a certain series, to things the best known in nature; so that a knowledge of particulars cannot be properly had without an exact comprehension of universal nature; it is not easy, on the footing of sound judgment, to maintain the contrary. For it seems improbable, that any true knowledge can be had, till the mind is perfectly versed in the explanation of causes: and to attribute a complete knowledge of the universe to the human mind, might seem rash and injudicious.

On the other hand, the patrons of this opinion, without explaining themselves in this way, have ventured to profane the oracles of the senses; which is bringing things to the utmost despair. But to say the truth, though they had not thus calumniated the senses, yet the dispute might seem to be contentious, and unseasonable; since without that precise truth they seem to mean, there is such a wide field left open to human industry, as makes it preposterous, and almost madness to be solicitous about securing the extremities of things; and at the same time overlooking, and disregarding things of such infinite use as lie in the middle. For how much soever they would seem to destroy the certainty, and yet retain the use of knowledge, by their distinction betwixt truth and probability; and with regard to the active part, leave a free choice of things; yet by taking away the hopes of discovering truth, they have doubtless cut the sinews of enquiry; and by a confused licentiousness in their own searches, turned the business of invention and discovery into disputes, and the exercise of the wit.

We cannot however deny, that if we have any fellowship with the ancients, it is principally in this their kind of philosophy; as we approve many of the things they have prudently observed, and delivered, upon the deceptions of

senses, the weakness of the judgment, and the withholding of the assent. And to these we might add many other particulars, of the same tendency: so that the difference betwixt them and us only lies here, that they will have nothing to be justly knowable in any way; and we not in the way which men have hitherto gone. And if we admit into our society, not only such of the ancients as hold this opinion in theory, and speculation, but such also as manifest the same in questions and objections, either by loudly complaining of the obscurity of things, or secretly revolving it in their minds, and only now and then whispering it out; there will be found the greatest men of antiquity in the number: heroes in contemplation, and such whose company any one might wish to be found in. For though perhaps one or two of the ancients have shewn a confidence, and a positiveness in pronouncing; yet this has been no prevailing practice till of late, in barbarous ages; and is only still retained through faction, or party negligence and custom.

But as to the society we thus join in, every one will easily perceive that we only concur with them in the setting out; and differ widely from them in the end: for although there may at first seem no great difference between us, as they simply assert the insufficiency of the human understanding; and we only in a certain respect;

yet at last they, neither discovering, nor hoping to discover, any remedy of the misfortune, forsake the business, and falling foul on the certainty of the senses, subvert the firmest foundations of science: whilst we, by introducing a new method, endeavour to rectify and repair the errors, both of the senses and the mind itself. So that whilst they, looking upon the thing as past recovery, give themselves up to a certain licentiousness, and wandering of thought we, from our preconception, have undertaken a more remote and difficult task, which we ardently wish may rebound to the felicity of mankind.

The entrance of the road we pursue is described in the second part of our Instauration, or Novum Organum; and followed in the third part, the Phænomena of the Universe, in our Sylva Sylvarum; where we endeavoured to penetrate, and pass through the Woods of Nature, thick set and darkened with a great variety of experiments, as with leaves; and entangled and twined together, like shrubs and bushes, with the subtilty of observations.* We are now perhaps proceeding

* Hence appears another reason why the author's History of Nature was entitled Sylva Sylvarum; besides that of the simple meaning of those words, denoting only a Repository or Magazine of materials, of all sorts: for the figurative sense is, as here explained, a thick wood of experi-

to the more open parts of nature; which however are still more difficult; and having got thro the woods, are come to the bottoms of the mountains: for though the way was never attempted before, we shall lead on from particular histories to universals, in one certain and continued path.

And here we cannot but observe, that those two famous ways of the ancients in active life, have a great correspondence with the ways of contemplation; the one whereof being at the first plain and easy, leads on to cragged, dangerous, and impassable places; but the other beginning steep and difficult, ends in a plain: for in the same manner, he who at the first enquiry into nature, lays hold of certain immoveable principles in the sciences, and trusting to them, shall hope to find out every thing else, as it were at leisure; if he proceeds in his enquiries, without being over satisfied or dissatisfied by the way, will find himself got into the first of these roads. But he that shall be able to withhold his judgment, ascend by degrees, and pass as it were over the tops of mountains, climbing first up one, then up another, and so to a third, with true patience

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ments and observations; and with relation thereto, the fourth part of the Instauration is sometimes called Filum Labyrinthi; as being the clue of the Sylva Sylvarum.

and unwearied diligence; will in due time arrive at the heights and top rounds of nature, where there is a sure footing, a serene station, and a beautiful prospect of things: with a gentle and easy descent, leading down to all practical arts.*

Our design therefore is this; that as in the second part of our work, we have laid down precepts for a just and legitimate enquiry into nature; so in this fourth part we would give examples of such an enquiry, in a variety of subjects; in such a manner as we judge to have the exactest correspondence with truth. and therefore deliver as a manner chosen and approved.

We do not however, after the common custom of men, propose our own forms and methods of enquiry, as if they were inviolable, the only ones, and perfect in all their parts; so as to make it absolutely necessary to use them: for we would by no means cramp or confine the industry and felicity of mankind. There is no doubt but men of genius and leisure, either of themselves, or as being now freed from the difficulties which ne-

* Hence we see the reason why this fourth part of the Instauration is sometimes called Scala Intellectus, or the steps of the understanding; by which it ascends to the regions of truth; or, without a figure, to the general axioms of sound philosophy; that at once contain both the theory and practice of all arts and sciences. And this philosophy was to have been the sixth and last part of the Instauration.

cessarily attend the first breaking of the ice of experience, may carry our method to greater perfection:* and it is our earnest desire, that the true art of conducting enquiries should improve; as it certainly will, since all arts must improve with new discoveries. Only this we must say, that after trying all the ways we could think of, and having had long experience of our present method of conducting enquiries, we have found none equal to it, for the commodiousness it affords in working with the understanding.

If we are accused of going into a new way of acquiring and delivering knowledge, and dropping the method of procedure by doctrine and precept, as if we over-looked it; and principally prosecute the business by examples; we answer, that we think there is the utmost reason for this procedure. And we would not have mankind ignorant of the course we take; for it is their business, not our own, that is now before us: and we judge their common fortune is concerned in the execution.

And first; we seem by this method to secure one principal point, which is that of being clearly understood: for it is one thing to subjoin ex-

* The author's motto is "Moniti Meliora." See Dr. Hook's Method of Improving Philosophy; and M. Tschirnhaus's Medicina Mentis.

amples to particular precepts, respectively; but a very different one, to construct and exhibit a perfect, and, as it were, solid figure and model of the whole work. Thus, for instance, several problems in mathematics and astronomy may, by the assistance of globes and proper machines, be clearly and easily solved; and would, without such contrivances and assistances, appear much more difficult and perplexed than they really are. And here it usually happens, that the larger the instrument is, the clearer and more satisfactory the demonstration proves.

We also hope to find a considerable advantage from this simple and gentle procedure; which neither offers violence, nor lays snares for the judgment; but barely, and nakedly, exhibits the thing. No writer has before us led mankind to the fountains of nature, and things themselves, for a common good; but all of them have applied examples and experience to confirm or illustrate their own dictates and doctrine, without leaving others the liberty of judging for themselves: insomuch that we hope to have deserved well of mankind, in two things which they hold dear; for we leave them at once in possession both of power and liberty:—power, with regard to works; and liberty, in point of judgment.

And as, in courts of justice, that procedure is ever the best, where least room is given to the

licentiousness of the pleader, though ever so eloquent; but all the time and pains are bestowed in examining the witnesses: so, in the courts of nature, the judgments of men are then best employed, when the least liberty is allowed to contention, dispute, and plausible discourse; but the mind wholly employed upon examining the evidence, and collective testimonies of experience: for, in the testimonies of authors there is heat, and licentiousness; but the answers and testimonies of things themselves, though they may indeed be sometimes obscure and perplexed, yet they are always sincere and uncorrupt.

Again, we seem by this means to keep clear of a great inconvenience, that might arise from the pride and prejudice of mankind: for prudent, grave, and wary men, suspect every new thing of levity and vanity, and contemn new sects and new opinions, as masks and mummeries; judging it of little significance, whether men agree in their theories or not; only that the old ones, and such as are more current and received, are best fitted for business, and conducting the affairs of the world, on account of general consent, and moral considerations. Now there is no remedy for this inconvenience, but by the copiousness of the example to strike so far into the senses of mankind, that any one of a tolerable judgment, shall, at first sight, perceive the thing to be sober

and solid, and pregnant with usefulness, and works; and immediately acknowledge it of a quite different nature and tendency from that of raising of a new school, or a new sect.

By this means likewise, we are not without hopes to abolish, in some degree, that authority and confidence which men have placed in the ancients, and others; who introduce their own opinions and notions into philosophy; at the same time that we preserve the respect and reverence due to them: and this not by any artifice, but from the simple force of the thing itself.

We farther conceive, our method may lead men to reflect, whether the ancients have, themselves, made use of this kind of diligence; and built their doctrines and opinions on sure foundations. And indeed this might, to some, appear a point of debate: if only the opinions of the ancients had been handed down to us, without the least intimation of their method of enquiry and demonstration: for then we might be apt to suspect, that from the very first of their contemplations, they had procured a large stock of examples; and disposed them in a similar, or perhaps a better order, than ourselves; and that they pronounced after a thorough examination of the matter; and at length set down their determinations, with their explanations and correc-

tions, in writing; only adding here and there an example or two, for the sake of instruction; but judged it unnecessary and tedious, to publish their first notes, rude draughts, hints, journals, and common-place-books: thus imitating builders, who, after they have raised their pile, take away the scaffolding. But themselves will not suffer us to think thus of them; for they openly declare the form and manner they used in their enquiries: and their writings give us a clear and express image of it. Their method was, from certain examples, most familiar to the senses, to rise at once to the most general conclusions, or principles of the sciences; and according to the fixed truth hereof, to derive inferior conclusions by intermediates. And having once established this art; if any controversy afterwards arose, about an example that seemed to contradict their principles, they rendered it conformable to them by distinctions, or the application of their own rules. Or if any mention was made of the causes of particular things: they ingeniously accommodated them to their own speculations. And hence we have a distinct view both of the thing itself, and the error of their whole procedure: for they plainly dismissed experience too soon, and either neglected the intermediate conclusions, which are the animating souls of works; or rested them upon a weak foundation;

and, what is not represented, substituted an illegitimate and unprosperous subtilty of wit, for sense itself. And if at any time there is mention made in their writings, of examples and particulars, these come too late; and after they had past sentence, and fixed their positions. But our method is directly opposite to this; as will be abundantly manifest from the tables themselves.

This therefore being the case, we shall still leave the ancients unrivaled, and in full possession of all that praise and admiration which any one shall think their due. And some of them were, doubtless, men of an excellent genius; which our method has little occasion for: since it puts the capacities and powers of mankind nearly upon a level. Thus, if a long set speech were to be delivered by memory; a man of a good memory would have a great advantage over another of a bad one; but if they were both to read their speeches, the difference in that case would be none at all. And thus it is in the contemplation of things, which depends entirely upon the powers of the mind; where one man infinitely excels another. But where the enquiry is carried on by tables, and a due use and application thereof; there is not much more difference than we usually find in the senses of men. And indeed, we are afraid of a too great subtilty

and agility of genius in our method; whilst men are carried away with their own impetuous motions: and would therefore add, not wings, but weights to their capacities.

Nay, by means of our tables, we question not but to secure the most difficult point of all; and bring it about, as it were, spontaneously, that after mankind, (though at the first entrance it may seem somewhat difficult and strange) shall be a little accustomed to the natural subtilty of things exposed to their view; and become familiar with their differences, plainly marked out in experience, they shall soon look upon that subtilty of words and disputes, which has hitherto employed and detained their thoughts, but as a ludicrous thing, a kind of charm, infatuation, or spectre; and pronounce of nature, what is usually said of fortune, that she has a lock before, but none behind: as all that late and preposterous subtilty of dispute, coming after the time of things is past, only catches at, but never lays hold of nature.

We also judge ourselves here, to use a true, lively, and animated form of instruction: for we do not pluck the sciences, like flowers, from the stalk; but deliver them over, roots and all, that they may be transplanted, or new set, in better genius's, as in a more fruitful soil; that will bring them to greater perfection. And for the

errors, over-sights, imperfections, and abrupt breakings-off of our enquiries, we, in our method have this advantage, that our errors may easily be observed, and rejected, before they can deeply infect the mass of knowledge; that our imperfections and defects may be readily supplied and corrected; and the enquiries left unfinished, be continued under a successive course of additions and improvements: and it is then that men will know their own strength, when infinite numbers shall not do the same things over and over again; but some supply and finish, what others begun and left imperfect.

We have also hopes, by this method, to prevent the retortings whereto our frequent mention of works might have exposed us, if we had not pressed mankind to converse with things themselves: for men cannot now well require those works from us, which we require from them; whilst any one may easily perceive, that we do not barely talk about works, because the tables themselves contain some draughts, designs, and earnests of new works; and, at the same time, plainly shew that our scope is not in the empirical manner, to derive works from works; but, like interpreters of nature, causes from works; and again, new works from those causes. Thus avoiding an unseasonable and hasty turning aside to works, at the beginning;

but observing, and waiting, the due and appointed time of the harvest.

In the last place, we hope also by this means to possess mankind of a just opinion, not only of the efficacy and intention of our work; but also of the bulk and magnitude thereof: and thus prevent them from imagining that the work we labour with, is an immense thing, beyond the power of mortals to effect; whereas it generally happens that the most useful things are the least voluminous. And though the enquiry into nature we have here begun, may be too much for a few; it might prove a facile work for a society of men. And with a view to shew this still more clear and practicable, we shall here subjoin a catalogue of general tables, that may, perhaps, include the whole.

A CATALOGUE OF GENERAL TABLES; FOR ENQUIRING INTO ALL THE WORKS OF NATURE.

TABLES for the enquiry of motion.

Tables for the enquiry of heat and cold.

Tables for enquiring into the operations, impressions, and influence of things at a distance.

Tables for enquiring into vegetation, and life of all kinds.

Tables for enquiring into the actions and passions of the animal body.

Tables for enquiring into the senses, and their objects.

Tables for enquiring into the affections of the mind.

Tables for enquiring into the mind and its faculties.

And these tables regard the separation, or division of nature, in point of form; but the following regard the construction of nature in point of matter.

Tables of enquiry into the structure, or architecture of the universe.

Tables for enquiring into the great relations, or accidents, of existence.

Tables for enquiring into the consistences of bodies, or their inequality of parts.

Tables for enquiring into species, or the fabrication, and common associations of things.

Tables for enquiring into the lesser relations, or properties, of bodies.*

And thus the universal enquiry may be comprehended in thirteen general tables, with their dependents or lesser tables; which are to be made occasionally, or as immediate use shall re-

* What additions, or improvements, might be made to this catalogue, for promoting the general design thereof?

quire: for we in no case proceed without our tables, or papers. As a specimen, we will here annex that set of tables, required by our method in the case of motion; which is a copious and diffusive subject.

A TABLE FOR A LEGITIMATE ENQUIRY INTO MOTION.

The inferior machine of the understanding, or a sequence of tables upon the first view.

Collective tables, exhibiting a digest, or regular series of history to the first article; to shew the terms and differences of motion.

A table of motion by external application; or motion of adherence.

A table of motion by internal application; or the motion of mixture.

A table of the motion of application to fibres; or the motion of identity.

A table of the motion of assimilation.

A table of the motion of impression; or signature.

A table of the motion of excitation.

Collective tables of digested history, to the second article.

A table of the subjects of motion.

Collective tables of regular history to the third article.

A table of the vehicles; or conveyancers of motion.

Collective tables of regular history to the fourth article.

A table of the operations and consequences of motion.

Collective tables of regular history to the fifth article.

A table of the stages of motion.

Collective tables of regular history to the sixth article.

A table of the sphere of activity of motion.

Collective tables of regular history to the seventh article.

A table of the government and regulation of motion.

A table of regular history to the eighth article.

A table of the associations of motions.

Collective tables of regular history to the ninth article.

A table of the affinities, or relations of motion.

Collective tables of regular history to the tenth article.

A table of the uniting powers in motion.

Collective tables of regular history to the eleventh article.

A table of the powers of customs and innovations in motion.

Collective tables of regular history to the twelfth article.

Tables of all the other observables of motion, not mentioned above.

A table of indications; or the primary dissection.

A table of secondary division.

A table of observations; or imperfect axioms.

A table of apparent impossibilities; or desiderata for human uses.

A table of occasional uses in active life.

A table of imperfect interpretation.

Tables of transportation, directing of new ones.

The superior machine of the understanding; or a sequence of tables upon a review.

New tables for changing, diversifying, or transposing the enquiry.*

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* This draught of a general table may appear somewhat unintelligible, unless the inductive method of enquiry, delivered in the Novum Organum, be previously understood. We do not find that the author has any where prosecuted the enquiry into motion, according to this model. But naked as it is, it has a capital use; and shews the way of working in the tabular method, so as to demonstrate the whole process both of the mind and body, in conducting enquiries: which is the end it is here proposed to answer.

For farther illustration, take another example of our tabular method of enquiry, in a less general, though copious subject; the affair of light and splendor.

A TABLE OF ENQUIRIES FOR THE PARTICULAR HISTORY OF LIGHT AND SPLENDOR.

In the first place, draw up a table of all those bodies of every kind, which afford light: as, 1. the stars, fiery meteors, flame, wood, metals, and other ignited bodies. 2. Sugar, in scraping and breaking; glow-worms; salt water struck and scattered abroad; the eyes of certain animals; rotten wood; and large tracts of snow. Perhaps also the air itself may have a feeble light; adapted to the eyes of such creatures as see by night. 3. Iron and tin, when put to dissolve in aqua-fortis, bubble and boil up, without the assistance of fire, and also conceive heat;

Those who require farther instruction, may consult any of the other tables of enquiry, that are prosecuted; as, particularly, that prefixed to the History of Life and Death; if the following one, for the History of Light and Splendor, be not sufficient. See also the Novum Organum, Part II. and the Preliminary Discourse to the abridgment of Mr. Boyle's Philosophical Works.

but whether they afford any light must be farther examined. 4. The oil of lamps sparkles in severe cold weather; and a certain degree of light has sometimes been observed, in a clear night, about a sweating horse; and sometimes also, though rarely, about the hair of men's head, in the nature of a feeble lambent flame. A woman's stomacher has also been observed to shine upon rubbing; but as the colour thereof was green, and alum is an ingredient in that dye, it was probably owing thereto, for it also crackled a little when it shone; but whether alum, in scraping or pounding, affords light, should be farther examined, though the force applied to it for this purpose, must perhaps be greater than that used to sugar, it being a more stubborn body. Some stockings also have been observed to shine, in pulling them off; whether this proceeded from sweat, or from alum used in the dye. Let all such instances be collected, and orderly disposed into this first or presence table, to shew in what subjects the thing we enquire after resides.

In the next place, let a table be formed of such bodies as yield no light at all, and yet have a great resemblance with those that do. Thus boiling water affords no light, nor air, though violently heated. Looking-glasses and dia-

monds,* which reflect light so very remarkably, yet yield none that is original and their own, with other instances of the like kind; and among them let a diligent enquiry be made after those we call travelling instances, that is, where light is present and absent, transiently or by turns: thus an ignited coal gives light, yet, if strongly compressed, it presently ceases to be luminous; but the crystalline matter of the glow-worm, though broken and divided into parts, retains its light for a small time, though it vanishes soon after. And this whole collection of instances, ranged in proper order, will form what we call the absence table, and exhibit all the bodies wherein the subject enquired after does not reside, though they nearly approach to those wherein it does reside.

Let it be next enquired, what light is more and what less intense and vibratory. Thus the flame of wood yields a strong light, the flame of spirit of wine a weaker, and the flame of coals thoroughly ignited yields a light that is dusky and scarce visible. And the proper instances of this kind, collected, will furnish out what we call the degree table.

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* Do not diamonds, under certain circumstances, afford a light in the dark? See Boyle and Stahl.

ARTICLE I.

THE COLOURS OF LIGHT.

LET the enquiry next proceed to the colours of light, to shew what they are, and what they are not. Some of the stars are white, others shining; some reddish, and others livid. Common flames, corruscations of the air, and the flame of gunpowder, are principally whitish; but the flame of sulphur beautifully blue. Some bodies also yield purple flames; but there have hitherto been discovered no green one, though the light of the glow-worm has a tendency thereto. Scarlet flames also have not been observed; but ignited iron is red, and, when intensely ignited, whitish. But all the instances of this kind are to be collected, and thrown into a table, to shew all the variety of colours in light.

ARTICLE II.

THE REFLECTIONS OF LIGHT.

LET it be next examined, what bodies reflect light, as speculums, water, polished metals, the moon, and gems. All fluid bodies, and those that have a very smooth and even surface, afford some degree of splendor, which is no other than a faint degree of light.

It must be diligently examined, whether the light of a lucid body may be reflected by another

that is lucid, as suppose ignited iron were exposed to the sun's rays: for light is reflected again and again, from speculum to speculum, though gradually fainter and weaker.

ARTICLE III.

THE MULTIPLICATIONS OF LIGHT.

LET the enquiry next descend to the multiplication of light, as by speculums, telescopes, and the like, which have a power to sharpen light, and throw it to a great distance, or else render it more subtile and better disposed for distinguishing visible objects, as we see by the practice of jewellers, and other artists, who set a spherical glass of water between the candle and their work.

It must likewise be examined, whether all bodies, when in a large quantity, do not reflect light; for it is very probable that light must pass through, or be reflected. And thus the moon, though it were an absolutely opaque body, yet might, on account of its magnitude, reflect light. Let it likewise be examined, whether the approximation of lucid bodies does not multiply light; which, in bodies that are equally lucid alike, cannot be doubted: but whether the light which is totally overpowered by a greater light, so as of itself to be rendered invisible, does not yet add some quantity of light, must be farther

examined. Even glossy bodies contribute to the increase of light: for a chamber hung with silk is lighter than when hung with cloth. Light is also multiplied by refraction, for gems that are cut with angles, and broken glass, are more splendid than when plain or entire.

ARTICLE IV.

THE WAYS OF DROWNING LIGHT.

THE methods of drowning light should next be enquired into, as by the predominancy of a greater light the grossness or opacity of the medium, &c. Thus, the sun's rays playing upon a culinary fire, causes the flame to appear as a certain white kind of smoke. All the instances of this kind should be collected.

ARTICLE V.

THE OPERATIONS OR EFFECTS OF LIGHT.

THE operations or effects of light come next to be examined, though they seem to be but few, and have little share in bringing remarkable changes upon bodies, especially those that are solid: for light, above all things, generates itself and other qualities, but sparingly; however, it certainly attenuates the air, is grateful and chearing to the spirits of animals, excites the languishing rays of colours and visible objects; for colours are nothing more than the refracted

image of light. But the particulars of this kind are to be diligently hunted up and collected.

ARTICLE VI.

THE CONTINUANCE OF LIGHT.

THE continuance of light may be next examined, though it seems to be but momentary; for notwithstanding light has continued in a chamber many hours, it illuminates the chamber no more than it did the first moment: but the case is quite otherwise in heat, &c. for the first heat remains, and a new one is superadded thereto. The twilight is, by some, conceived to be the remains of the sun's light.

ARTICLE VII.

THE DIRECTIONS, MOTIONS, AND PASSAGES OF LIGHT.

THE directions, motions, and passages of light should be very attentively examined.—Light is diffused all round; but whether at the same time it ascends a little, or is equally diffused upwards and downwards, must be enquired into. Light produces light every where about it; so when the body of a taper is not perceived through the interposition of a blind or obstacle, it still illuminates all the objects around it, excepting those that are in the shadow of the veil. And yet even these objects are somewhat illuminated by the light thrown about them; for

an object standing within this shade may still be much better perceived than if no light at all were present; and therefore the visible body of any luminous matter, and light itself, are two very different things. Light does not penetrate fibrous bodies of an irregular and disorderly texture, though it still is not hindered by solidity and hardness as we see in glass, &c. and therefore only straight lined bodies, whose pores lie not transverse, seem capable of transmitting light.

Light is excellently transmitted through the air, which the purer it is, the better the light passes. But whether the light be conveyed by the body of the air, as sounds are by the winds, or in any other manner, should be examined, with other matters of the like kind, to complete this article.

ARTICLE VIII.

THE TRANSPARENCY OF LUMINOUS AND LUCID BODIES.

It should next be examined, what lucid or luminous bodies are transparent. The wick of a candle is perceived thro' the flame, but objects are not visible through large bodies of flame. On the other hand, all transparency is lost in a body upon ignition, as appears in glass. The body of the air is transparent, so is water; but when these two transparent bodies are mixed together in snow or froth, they no longer preserve

their transparency, but acquire a certain original light.

ARTICLE IX.

THE AGREEMENTS AND DISAGREEMENTS OF LIGHT.

THE agreements and disagreements of light must be enquired into. Light has a principal correspondence and affinity with three things, as to its generation, viz. heat, subtilty, and motion; the conjunction and separation whereof, in respect of light, must therefore be examined, together with their degrees. The flame of spirit of wine, or the ignis fatuus, is much milder in heat, but stronger in light than ignited iron. Glow-worms, the dewy vapour raised by the dashing of salt water, and many other things above mentioned, yield light, though they are not warm to the touch. Ignited metals are not subtile bodies, yet they have a burning heat. On the contrary, air is one of the subtilest bodies, yet has no light. Again, winds, though very rapid in their motion, afford no light. Contrariwise, ignited metals have but a dull and languid motion, yet vibrate light.

But there is nothing so nearly related to light, not indeed with regard to its generation, but only to its passage, as sound, and therefore their agreements and disagreements are to be diligently sought. Some of their agreements are

these. 1. They both diffuse themselves in a sphere. 2. They both move to very great distances, but light the swiftest, as appears in the discharging of cannon, where the light is first perceived before the sound, and the flame follows after. 3. They have both very subtile differences, ; sounds in the articulation of words, and light in all the images of visible things. 4. They both produce or generate little, except in senses and spirits of animals. 5. They both are easily generated, and soon vanish. 6. Light is drowned by a greater light, and sound by a greater sound, &c.

Some of their differences are these. 1. Light moves swifter than sound. 2. Light moves farther than sound. 3. Light moves only in a straight line, but sound obliquely and every other way: for when an object is perceived in the shade of an obstacle, it is not because the light penetrates the obstacle, but only illuminates the air round about, whence the air behind the obstacle is also somewhat illuminated. But a sound begun on one side of a wall is heard without much diminution on the other. And again, sound is heard from withinside a solid body, as in the eagle-stone, or from bodies struck under water; but light is not at all perceived in a transparent body that is every way obstructed or surrounded. 4. Lastly, all sound is generated in

motion, and a manifest stroke of the sounding body, which in light is otherwise.

But for the disagreements of light, there have been none hitherto observed, unless privations may be called disagreements. And it should seem that sluggishness in the parts of bodies is the greatest enemy to light, for scarce any thing is luminous that is not in its own nature remarkably moveable, or easily excited either by heat, motion, or vital spirit. But this enquiry should be further prosecuted. And we always mean, not only that other new instances should be diligently sought out, in conformity with those few which we only produce as a specimen, but likewise that new articles and tables of enquiry should be set down, added, and drawn up as the nature of the subject directs or requires.*

* This subject of light is prosecuted to a considerable length by Dr. Hook, in his Lectures of Light; by Mr. Boyle, in his Experiments and Observations upon Colours; M. Huygens de la Lumiere; and since by Sir Isaac Newton, in his Treatise of the Reflections, Refractions, Inflections, and Colours of Light.

A

DELINEATION

OF THE

PARTICULAR HISTORY

OF

LIFE AND DEATH;

WITH A VIEW TO

PRESERVE HEALTH, RETARD OLD AGE, AND LENGTHEN THE PRESENT PERIOD OF HUMAN LIFE.

PREFACE.

THE subject of human Life and Death is, of all natural subjects, the most interesting to men; and, as such, the author has treated it with uncommon diligence. The enquiry is conducted in the inductive method; and carried to a considerable length: with directions for continuing it still farther, till we arrive at a knowledge of the cause and form of life and of Death. The whole being left in such forwardness, it may naturally be asked why it has not been since brought nearer to perfection? The principal reason I can assign is, that physicians have been otherwise employed: and men of different professions seem discouraged from improving an art they do not practise. The disease is easier found than the remedy. Nor can a capital remedy, in this case, be expected till men shall, in some degree, have conquered their passions; and shew a less regard to private, and a greater to public good. The author, has shewn by an illustrious example, that persons of a public spirit, might, though they were not bred to

physic, treat the subject of Life and Death to advantage.

That the full scope and conduct of the piece may be understood, it will be proper to remember the doctrine laid down in the second part of the author's Novum Organum; concerning the method of prosecuting enquiries.

INTRODUCTION.

THE shortness of life, and the slow advancement of arts, has been an ancient complaint. It is therefore agreeable to our design of bestowing the utmost pains upon the perfecting of arts, to consider also the ways of prolonging human life. But this enquiry is pressed with difficulties; the rather, because of false notions and opinions concerning it: for what the physicians have frequently in their mouths about radical moisture, and natural heat, are but delusory conceits; and the extravagant commendations of chemical medicines, do but first swell up, and then disappoint our hopes.*

The present enquiry is not directed to that kind of death which proceeds from suffocation, putrefaction, and diseases; for this belongs to medicinal history:† but to that death only, which comes on by resolution, and a wasting of the parts, through old-age. The last step, indeed, of death, or the total extinction of life, (which may happen so many ways, both external and internal; though they have all of

* The virtues of pharmaceutical preparations are so unsettled, that it is generally little more than levity, to extol or decry particular remedies.

† See the Introduction to the Sylva Sylvarum.

them, as it were, one common avenue at last,) has some relation to our design: and brings up the rear of the enquiry.

Whatever may be gradually repaired, without destruction to the original whole, is, like the vestal fire, potentially eternal: whence physicians and philosophers, observing that animals are totally nourished, aud their bodies recruited and supplied, though not for any long continuance; but soon after grow old, and hasten to a dissolution; they have sought for death in a subject not properly capable of repair; and judged, that a certain radical, and primitive moisture, could not be totally recruited; but that there was a certain spurious apposition of parts, and not a just repair, carried on from infancy, and gradually degenerating with age; till, at length, this depravity ends in non-existence.

This is but a crude and flashy notion; for all the parts of an animal in youth, and in a growing state, are totally repaired; and, for a time, not only improved in quality, but augmented in quantity: insomuch that the recruiting matter might be, in some measure eternal, if the manner of recruiting did not fail. But here lies the case, that in declining age, the repair is made very unequally; some parts being successfully nourished, but others with difficulty, and for the worse: so that from this time, animal bodies begin to suffer the mezentian torment, of having the live parts die in the embraces of the dead ones; those that are easily reparable failing, through their conjunction with such as are not: for when age is upon the decline; the spirit, the blood, the flesh, and the fat, are easily repaired; but the dryer, or more spongy parts; the membranes, the coats, the nerves, the arteries, the veins, the bones, the cartilages, most of the viscera, and nearly all the organical parts, are repaired with difficulty and loss.

And as these parts must of necessity officiate in the actual repair of the more reparable parts; but, being thus diminished in their activity and powers, can no longer perform their

functions; it follows, that all of them soon begin to languish; and the parts, in their own nature most reparable, now wanting the service of the organs of repair, can no longer be commodiously supplied; but impoverish by degrees, and at length totally fail.

The cause of this revolution lies here, that the spirit, like a gentle flame, is perpetually preying upon the parts;* and in conjunction with the external air, which also drinks and dries up tangible bodies, at length destroys the work-shop of the body, its instruments and machines; and thus renders them unfit for performing their office. And this is the true process of natural death; which requires to be thoroughly considered: for he who knows not the ways and courses of nature, can never oppose and bend her.†

This enquiry, therefore, consists of two parts; with respect, 1. to the consumption or depredation of the body; and, 2. to its repair, or recruit: with a view, as much as possible, to prevent the former and promote the latter. The first has a principal regard to the spirit, and external air, which make the depredation; and the second, to the entire process of alimentation, which supplies the repair.

The enquiry of the consumption has many things in common with inanimate bodies: for the effects which the innate spirit, residing in all tangible substances, whether animate or inanimate, and which the external air produces upon inanimate bodies, are likewise endeavoured upon animate bodies; whilst the interposition of the vital spirit, on one side, checks and restrains their operations; and, on the other, powerfully promotes them. For it is plain, that many ina-

* Let this consideration, of the spirits preying upon the other parts, be duly regarded: it is of great importance to what follows. See Sect. I.

† As it is necessary he should do, who would endeavour to lengthen the present period of human life.

nimate bodies may endure a long time without repair; whereas animate bodies presently fail, without nourishment and recruit; thus, like fire, becoming extinct.

Our enquiry therefore must be double; and regard first the human body, as a thing inanimate and unsupported by aliment; and secondly, as a thing animate and nourished.*

And this enquiry, we hope, might redound to a general good; if physicians would but exert themselves, and raise their minds above the sordid considerations of cure: not deriving their honour from the necessities of mankind; but becoming ministers to the divine power and goodness, both in prolonging and restoring the life of man: especially as this may be effected by safe, commodious, and not illiberal means; though hitherto unattempted.† And certainly it would be an earnest of the divine favour, if, whilst we are journeying to the land of promise, our garments, these frail bodies of ours, were not greatly to wear out in the wilderness of this world.

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* Observe the sagacity and judgment in distinguishing and fixing the two capital points of the enquiry.

† See hereafter, Sect. VIII.

HISTORY

OF

LIFE AND DEATH.

SECT I.*

THE GENERAL TABLE OF ENQUIRY; OR A SET OF HEADS FOR THE PARTICULAR HISTORY OF HUMAN LIFE AND DEATH, WITH DIRECTIONS FOR THE CONDUCT OF THE WHOLE.

ARTICLE I.

A PREVIOUS enquiry into the nature of durability, and its degrees, in inanimate and vegetable bodies.

* It may be proper to observe at the entrance of this piece, that each section is what the author understands by a table, which is formed at many different operations of the mind, in the way of so many steps; whence the whole enquiry being artificially broke into a number of distinct and commodiously manageable parts, the mind both at first, and ever afterwards, operates with the greater ease, freedom, and advantage. For thus every table is a separate work, not finished, but left still open to receive farther additions and improvements. And when all the tables shall be per-

This article to be prosecuted, not at large, or in due form, but concisely, by certain heads, and as in passage.*

ARTICLE II.

Of dryness, arefaction, and the consumption of inanimate bodies and vegetables; with the manner and process they succeed in, and the ways of preventing and retarding all three: the preserving of bodies in their own state; and lastly, a more careful enquiry into the ways of softening, mollifying, malaxing, and recovering of bodies after they once begin to be dried.

Nor is a perfect, rigorous enquiry necessary under this article; both as these particulars may be deduced from their proper heads of durability, and are not capital things to the present purpose; though they afford light to the way of prolonging and restoring life in animals.

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fected, then, and not till then, will the whole enquiry be finished. So that the understanding has many more steps to take, before it arrives at a plenary knowledge of the form of Life and Death. This advertisement may be less necessary to those who are versed in the author's method of enquiry, laid down and exemplified in the second part of his Novum Organum.

* The directions, occasionally subjoined to these articles of enquiry, were not only intended to regulate the conduct of the author, but likewise the conduct of all future enquirers into the same subject.

From inanimate and vegetable bodies, let the enquiry descend to animals, exclusive of men.

ARTICLE III.

Of the long and short life of animals; with the proper circumstances which seem to have a share in the difference.

ARTICLE IV.

As the duration of bodies is of two kinds; the one consisting in simple identity, the other in repair; the first whereof obtains only in bodies inanimate; the second, in vegetables and animals, and is performed by alimentation; the next step of the enquiry must be, into the business of alimentation, with its ways and process.

Neither is exactness required here; because this belongs to the heads of assimilation and alimentation: and need only be touched, as the former, in passage.

The enquiry must next descend to man: and as this is the principal subject of all, the procedure should be here, in every respect, exact and perfect.

ARTICLE V.

An enquiry into the length and shortness of life in men, according to the different ages of

the world, countries, climates, places of nativity, and habitation.

ARTICLE VI.

Of the length and shortness of life in men, with regard to their origin and propagation, as it were in an hereditary manner; also with regard to their complexions, constitutions, habits of body, stature, manner and periods of growth, and the formation and knitting of the limbs.

ARTICLE VII.

Of the length and shortness of life in men, according to the times of their nativity: this enquiry being so conducted, as at present to drop all astrological and horoscopical considerations; and receive only the more manifest and common observations, if there be any; such as birth in the seventh, eighth, ninth, and tenth month, happening by night or by day, or in different months of the year.

ARTICLE VIII.

Of the length and shortness of life in men, with regard to their food, diet, manner of living, exercise, &c. the considerations of the air which men breathe, belonging to the fifth article, under the head of habitation.

ARTICLE IX.

Of the length and shortness of life in men, with regard to their studies, kinds of life; passions of mind, and various accidents.

ARTICLE X.

A separate enquiry into such remedies as are thought to prolong life.

ARTICLE XI.

Of the signs and prognostics of long and short life; not such as denote death at hand; which belong to medicinal history; but such as appear, and are observed, even in health; whether derived from physiognomy, or other considerations.

Thus far the enquiry proceeds upon the length and shortness of life, in an artless and miscellaneous manner: whereto it is proper to add an artificial enquiry, tending to practice, by three general intentions. We shall lay down the more particular distributions of these intentions when we come to the enquiry itself.* Let it only be observed for the present, that these three general intentions are, the prevention of waste, the perfecting of recruit, and the renovation of decay.

* See hereafter, Sect. VIII.

ARTICLE XII.

An enquiry into those things which preserve and exempt the human body from arefaction and consumption; or at least retard and ward off the tendency thereto.

ARTICLE XIII.

An enquiry into the particulars belonging to the entire process of alimentation; whereby the body of man is recruited, in order to its perfection, and the prevention of loss.

ARTICLE XIV.

Of the things which discharge the worn-out materials; supply new ones; and supple and moisten the parts that are dried and indurated.

But as it is difficult to know the ways of death, before its seat is discovered, this also must be enquired into; though not with regard to all kinds of death; but such only as proceed, not from violence, but from privation, and want of supply: for this kind alone belongs to the wasting of the body by age.

ARTICLE XV.

An enquiry into the point of death, and the avenues leading up to it, on all sides; through want of supply, and not through violence.

And as it is proper to understand the characteristic and form of old age, this enquiry must not be omitted; and is best made by diligently collecting, and comparing together, all the differences in the state and functions of the body, happening betwixt youth and old age; which, at length, will shew what the thing is that shoots out into so many effects.

ARTICLE XVI.

A CAREFUL enquiry into the different states of the body, in youth and old age; observing if there be any thing that remains the same unimpaired in age.*

SECT. II.

THE HISTORY OF DURABILITY; WITH REGARD TO THE FIRST ARTICLE OF THE TABLE OF ENQUIRY.

METALS are so lasting, that the observation of mankind is not sufficient to fix the time of their duration: even when resolved by age, they

* Here the author ends his own enquiry; leaving every article open to receive the improvements of others: only, in his usual manner, endeavouring to raise a set of axioms and canons, upon what is already discovered, in the way of first-fruits, and earnests of greater things.

are but turned to rust, without loss of parts: though gold suffers neither of these changes.*

Quicksilver, though a fluid, and extremely volatile in the fire, is not known either to waste or rust by age alone, without heat.

Stones, especially the harder kinds, and many other fossils, are exceeding durable; even though exposed to the open air; much more when buried under ground. Stones, however, gather a kind of nitre,† after the manner of rust; but gems and crystals are more durable than metals; though they lose somewhat of their splendor with great length of time.

It is observed, that stones are sooner consumed on the side exposed to the north, than on that exposed to the south; as appears plainly in pyramids, temples, and other buildings: whilst iron, on the other hand, rusts faster on the side exposed to the south than to the north; as we find by the iron bars of windows: and no wonder; since in all putrefactions, and rust is one, moisture promotes the dissolution, as dryness does in simple arefaction.

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* Unless its proper menstruum, the fumes or spirit of sea salt, happen to meet with it. Remark all along the author's method of proceeding by induction; or a collection of facts, observations and experiments; which when duly tabled, as so many data, give the quasita.

† I suppose this is meant of the nitrum murale.

Vegetables severed from the earth, and the trunks of the harder trees, timbers, &c. endure for some ages.* But the parts of the trunk are different; some trees being fistulous, as the alder, where the pith in the middle is soft, and the external part hard. but in timber trees, as the oak, the inner part, called the heart of the tree, is most durable.

The leaves, flowers, and even stalks of plants, are of small duration; and either putrefy or resolve to dust and ashes: the roots being the more durable parts.

The bones of animals last long; as we see in charnel houses. Horns and teeth are very durable; as appears in ivory, and the tooth of the sea-horse.

Skins, hides, and leather are also durable; as appears from the ancient manuscripts on vellum, &c. Paper also will last many ages; though it is less durable than parchment.

Bodies by passing the fire are rendered more durable; as glass, bricks, &c. Even flesh and fruits that have felt the fire, prove more durable than when crude: not only because the fire pre-

* There are certain trees, which in a very few years turn to moss, or mould, by lying buried in the ground. See Mr. Evelyn's Sylva, and the Philosophical Transactions.

vents putrefaction, but because when the aqueous moisture is gone, the unctuous moisture supports itself the longer.

Of all liquors, water is soonest absorbed by the air; but oil, on the contrary, exhales slowly, as appears both in the liquors themselves, and again when mixed with other bodies: for paper dipped in water, acquires some degree of transparency, but soon loses it again, and turns white, through the exhalation of the water; whereas paper dipped in oil, long remains transparent, because the oil does not exhale.

All gums are exceeding durable; so likewise is wax and honey.

But equability and inequability in the accidental circumstances of bodies have as great a share in the duration or destruction of them as things themselves: for timber, stones, &c. lying continually either in water or in air, last longer than if they were sometimes removed from the one to the other. So stones, laid in buildings with the same direction, as to the points of the compass, they had in the quarry, prove more durable than they otherwise would; and the case is the same in removing of plants.*

* Is this sufficiently verified?

TWO LARGER OBSERVATIONS.

LET it be held as certain, that there is in all tangible bodies a spirit, or pneumatical substance, enveloped and included in the tangible parts; and that this spirit is the origin of all dissolution and consumption; which are therefore to be prevented by the detention of this spirit.

This spirit is detained two ways; either by close compression and confinement, or by a kind of spontaneous residence. And this lodgment is solicited two ways; viz. if the spirit itself be not very moveable or sharp; and again, if it be not excited by the external air to desert. So that there are two durable substances, a hard one and an oily: the first constringes the spirit, and the second in some measure appeases it; and is less solicited by the air, for air is of the same substance with water; and flame with oil.*

And so much for the nature of durability in bodies inanimate.

The plants accounted cold, are annual, and die yearly, both in their root and stalk; as lettuce, purslane, wheat, and all kinds of grain: yet there are some cold plants which last for three or four years; as the violet, strawberry, pimpernel, prim-

* Let the justness of these larger observations, and their importance, be thoroughly perceived.

rose, and sorrel; but borage and bugloss, though so like when alive, differ in death; for borage is but annual; whereas bugloss lasts longer than one year.

Numerous hot plants bear age well; as hyssop, thyme, savory, common marjoram, baulm, wormwood, germander, sage, &c. but fennel dies yearly in its stalk, and shoots again from the root: whereas basil and sweet marjoram endure age better than they do the winter; for when planted in a warm and well fenced place, they flourish above one year: and a bed of hyssop, clipt every six months, has been known to continue forty years.

Shrubs and bushes continue flourishing for sixty years, and some for twice that time. The vine may live to sixty, and be fruitful even to the last. Rosemary well secured, will likewise reach to sixty; and bear's-foot, and ivy to more than a hundred. The age of the bramble cannot be well computed; because bending to the earth, it strikes fresh roots; so that it is hard to distinguish the new shoot from the old.

Among large trees the longest lived are the oak, the holm, the ash, the elm, the beech, the plane, the fig, the lote, the olive, the wild olive, the palm, and the mulberry: some of these will last eight hundred years; and the shortest livers of them all, two hundred.

But odoriferous and resinous trees are in their matter or wood still more durable. It is true, the cypress, the fir, the pine, the box, and the juniper are shorter livers; but the cedar, assisted by the bulk of its body, nearly equals the above mentioned.

The ash, brisk and quick in its growth, lives to a hundred years or more; so likewise do the birch, the maple, and the service-tree: but the poplar, the lime, the sycamore, and the walnut are not so long lived.

The apple, the pear, the plumb, the pomegranate, the citron, the lemon, the medlar, the cornel, and the cherry-tree, may last fifty or sixty years, especially if now and then scoured of their moss, which surrounds some of them.

In general, largeness of bulk in trees, where other things are equal, has some affinity with their continuance of life; so likewise has hardness of substance, and such as bear mast and nuts are generally longer lived than fruit-trees. So again, those that are late, either in fruit or leaf, and also shed late, are longer lived than such as bear and shed early: so wild trees are longer lived than those of the orchard, and of the same kind such as bear an acid fruit live longer than such as bear a sweet one.

A LARGER OBSERVATION.

Aristotle has excellently observed the difference between plants and animals, in point of nourishment and recruit, viz. that the bodies of animals remain confined within their own bounds; so that when come to a due magnitude, they are supported and preserved by their aliment, without the new growth of any thing but hair and nails, which are accounted excrementitious; whence of necessity the juices of animals sooner grow old; whereas trees often put out new branches, new shoots, new fruits; whence also the other parts become new, and feel not the effects of age, because whatever is green and young, more briskly and strongly attracts the nourishment to itself, than what has begun to grow dry; insomuch that the trunk itself, thro' which the sap is conveyed to the branches, thus comes to be watered, and supplied with a more rich and plentiful aliment,* as remarkably ap-

* Whence in effect the trunk becomes continually young again. This observation, therefore, is of great importance to the present enquiry, as it may in some degree be transferred from vegetable to animal subjects, and afford a rule for procuring a kind of rejuvenescency; as by the use of frictions, &c. on the external parts of the body, so as to perspire the old juices, and cause those parts more strongly to attract new ones.

pears from hence, that in the cutting of hedges, the lopping of trees, and the thinning of coppices, the stem or trunk is always invigorated and rendered much longer lived by the loss of its shoots or branches.

SECT. III.

THE HISTORY OF DESICCATION, THE PREVENTION THEREOF, AND THE SOFTENING OF DRIED BODIES, WITH REGARD TO THE SECOND ARTICLE OF THE TABLE OF ENQUIRY.

FIRE or intense heat dries some bodies and melts others; it dries earth, stone, wood, cloth, hides, and all bodies incapable of melting; but fuses metals, wax, gums, fat, &c.

Even those things that melt in the fire are dried by it at last, if the fire be increased: thus metals, with a violent heat, lose their volatile part; and all of them, except gold, become lighter and more brittle;* and by a strong fire, oily and fat bodies become scorched, dry, and crusty.

* Even gold itself loses of its weight, and becomes a purple glass, when exposed to the focus of a large lens, or burning concave. See M. Homberg's paper upon the subject. Memoir. de l'Acad. An. 1702.

The open air is manifestly drying, but never melting; thus the surface of the earth is dried after being wet with showers; so linen is dried after washing, by exposing it to the air; and herbs, leaves, and flowers are dried in the shade, &c. but the air performs this much more powerfully when assisted by the sun's rays, or put into motion, as by winds, &c.

Age has a great, though an exceeding slow power of drying, as we see in all bodies, which, unless prevented by putrefaction,* grow dry with age; yet age is nothing of itself, or no more than the measure of time: but the effect is produced by the native spirit of bodies, which drinks up their moisture, and flies off together with it; whilst the external air multiplies itself thereon, and preys upon the native spirit and juices of bodies.†

But cold is properly the greatest drier of all, for there can be no dryness without contraction, which is the proper effect of cold. But as we have a powerful degree of heat in fire, and only a very feeble one of cold, as that of the winter, snow, ice, &c. the arefactions of cold are but

* Do not all bodies, after complete putrefaction, become dry and truly terrestrial?

† This might pass for a larger observation of capital import.

weak on the earth, and easily destroyed; yet we find the face of the earth more dried by frost and March winds than by the sun, whilst the same wind that licks up the moisture produces cold.*

The smoke of fire gives driness, as we see in the case of flesh suspended in chimnies; and so the fumigations of frankincense, lignum aloes, &c. dry the brain, and stop defluxions.

Salt by continuance dries not only externally but deeply, as appears in the salting of flesh or fish, which, lying long in the salt, are manifestly hardened, even internally.

Hot gums applied to the skin, dry and wrinkle it; so likewise do some astringent liquors.

High rectified spirit of wine dries almost like fire, so far as to harden and blanch the white of an egg put into it, and almost to scorch up bread.

Powders dry like spunges, by sucking up moisture, as we see in throwing sand upon fresh writing. Even a polish, or the close union of a body, not permitting a moist vapour to enter its

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* A freezing degree of cold even dries up water, or turns it from a fluid into a solid; and a still greater degree will congeal wine, brandy, oil of vitriol, and other mineral acid spirits: a still higher might congeal quicksilver itself, tho, this was never experienced in the utmost degrees of cold that men have hitherto been able to produce, not even by the mixture of spirit of nitre and ice.

pores, dries up by accident, as exposing the subject to the air. Thus gems, looking-glasses, and sword-blades, when breathed upon, appear at first covered over with a vapour, which presently vanishes like a light cloud. And so much for the article of desiccation.

In the eastern parts of Germany they make use of subterraneous granaries for preserving their corn, by laying straw at the bottom, and all around to some height, in order to repel and suck up the humidity of the cave; by which means they keep their grain for twenty or thirty years not only uncorrupted, but, what makes to the present enquiry, in such a state of freshness as excellently fits it for the making of bread. And the like practice, it is said, has formerly prevailed in Cappadocia, Thrace, and some parts of Spain.

Granaries are commodiously made in garrets or upper rooms, with windows open to the east and north; and some have two floors, an upper and a lower, for this purpose, the upper one being perforated, that the grain may continually fall through the holes thereof, like sand in an hour-glass, and some days after be again thrown back with shovels, so as to keep the grain in continual motion; by which contrivance corruption is not only prevented, but freshness preserved, and dryness retarded; the cause whereof, as we

intimated above,* is the discharge of the aqueous moisture, which being accelerated by the motion of the wind, preserves the oily moisture in its state that would otherwise fly off along with the aqueous. And thus on certain mountains, where the air is pure, dead corps will remain many days unfaded.

Fruits, as apples, pears, lemons, &c. and flowers, as roses, lilies, &c. may be long kept fresh in close stopped earthen vessels; though indeed the air from without is somewhat prejudicial, by communicating its inequalities through the vessel, as manifestly appears in the case of cold and heat; so that if the vessel were well stopped, it might be a good way to bury it in the ground, or plunge it under water that is shaded, as wells and cisterns generally are; though the bodies to be preserved under water had better be put up in vessels of glass than vessels of earth.

In general, bodies reposited under ground, and in subterraneous vaults, or deep waters, preserve their freshness longer than above ground.

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* See above, Sects. I. and III.

† See a method of preserving fruits and flowers for a year, built upon this foundation, in the Philosophical Transactions, No. 237, p. 44.

It is related, that in conservatories of snow, whether natural or artificial, fruit has been found as fresh and beautiful, after lying there for several months, as if it had been newly gathered.*

The country people have a way of preserving bunches of grapes, by burying them in meal, which, though it renders them somewhat unpleasant to the taste, yet preserves their moisture and freshness; and all the firmer fruits are not only long preserved in meal, but also in sawdust, or heaps of corn.†

An opinion has prevailed, that bodies are preservable, fresh and perfect, in liquors of their own species, as grapes in wine, olives in oil,† &c.

Pomegranates and quinces may be well preserved, by steeping them awhile in salt water, then taking them out and drying them in the open air of a shady place.

Bodies are long preserved by suspending them in wine or oil, much better in honey or spirit of wine; but best of all, as some say, in quicksilver.

Fruits are long preserved fresh and green by

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* See Mr. Boyle's History of Cold.

† See the author's Sylva Sylvarum, under the article *Preservation.*

coating them over with wax, pitch, plaister of Paris, paste, &c.*

It is manifest that flies, spiders, ants, &c. casually included in amber, or immersed and covered over with the gums of trees, never waste afterwards, though they are but soft and tender bodies.

Grapes and other fruit are preserved by hanging pendulous: of which situation there is a double convenience; for first they are thus preserved from bruising or compressure, to which they would be exposed by lying upon hard bodies; and secondly, the air surrounds them every way equally.

It is observed, that both putrefaction and desiccation in vegetables begin not equally on every side, but principally in that part through which bodies draw their nourishment when alive; whence some direct us, in preserving of fruit, to seal up the end of the stalk with wax or melted pitch.

Large wicks of candles or lamps consume the tallow or oil sooner than less, and the flame of cotton sooner than that of rush, straw, twig, &c.

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* These and many other of the following particulars are farther considered in the Sylva Sylvarum, from whence they may appear taken, for the present occasion, according to the design of that piece.

and all flame moved and agitated by the wind consumes the fewel faster than when undisturbed, and therefore slower in a lanthorn than in the open air. It is reported also that sepulchral lamps will continue burning for a very long time.

The nature and preparation of the fewel contributes as much to the continuance of the light as the nature of the flame. Thus wax burns longer than tallow, wet tallow longer than dry, hard wax longer than soft, &c.

If the mould be yearly stirred about the roots of trees, the trees are of shorter duration; but, if once in five or ten years, of longer: so to gather the buds, and strip off the twigs of trees, prolongs their life. Again, dunging, laying on of chalk, &c. and much watering, conduces to fertility, but shortens the life of vegetables.

And so much for the preventing of dryness and wasting. The business of softening bodies once dried, which is the capital business in this case, affords but a few experiments; we will therefore join such as belong to men and other animals together.

Willow twigs become more flexible by steeping them in water; so we dip the ends of birch rods in water to prevent their drying; and bowls of woods, cleft through dryness, being put into water, close again.

Very old trees, that have stood long unre-

moved, apparently grow young again, and acquire new and tender leaves, upon digging and opening the earth about their roots.

Leather, become hard and stubborn by age, is suppled and softened by rubbing it with oil before the fire, and in some measure barely by the warmth of the fire. Skins and bladders, when somewhat hardened, grow soft again in warm water, with the addition of any fat substance; but better still if rubbed a little.

Old draught oxen, worn out with service, being put into fresh pasture, get new and tender flesh, that eats like young beef.

A dry and strict diet of guaiacum, bisket, &c. used in the cure of the venereal disease, &c. brings men to extreme leanness, and consumes the juices of the body, which afterwards beginning to be recruited, grow manifestly more young and fresh; and we judge that emaciating distempers, being well cured, have prolonged the lives of many.

LARGER OBSERVATIONS.

Men have a strange talent, and see sharply in the night of their own notions, but wink and prove weak-sighted in the day light of experience: they talk of the elementary quality of dryness, of dryers, and the natural periods of bodies whereby they are corrupted and consum-

ed, without observing any thing of use, as to the beginnings, the means, and the ends of dryness and consumption.

The process of dryness and consumption consists in three actions, and these actions have their origin from the native spirit of bodies, as was before observed.

The first action is the attenuation of moisture into spirit; the second is the exit or escape of the spirit; the third is the immediate contraction of the parts of the body after the spirit is gone: and this last is that desiccation and induration we are now principally concerned with, the two former tending only to consume.

In the case of attenuation the thing is manifest; for the spirit included in all tangible bodies operates without ceasing, and whatever it lays hold of, can digest, and work upon, it converts into itself, entirely changes, subdues, multiplies itself thereon, and begets new spirit. This receives an eminent confirmation from hence, that bodies much dried lose in weight, become hollow, spungy, and sonorous from within; whilst it is certain that the internal spirit contributes nothing to the weight of the body: whence it necessarily follows, that the internal spirit must have converted into itself the moisture and juice of the body which before had gravity, whence the diminution of the weight. And this is the first

action; viz. the attenuation of the moisture and its conversion into spirit.*

The second action; viz. the escape or avolation of the spirit, is likewise manifest; for when this happens largely, it is apparent even to the sense, in vapours to the sight, and in odours to the smell; but when it happens gradually, as it does through age, it is then performed insensibly; though the case, in effect, be the same. And where the texture of the body is so close and tenacious that the spirit can find no pores or passages, at which to issue; here also, in its endeavour to get out, it drives the grosser parts of the body before it, and thrusts them above the surface: which is the case in the rusting of metals, and the corruption of all fat bodies.

The third action is somewhat obscure, but no less certain than the others, being a contraction of the grosser parts, after the spirit is discharged. And, first, we see that bodies manifestly shrink, and possess less space, after the exit of the spirit; as we find in nut-kernels, which when dried do not fill the shell: and again, in boarding and paling, where the several planks, or pieces of wood, are laid close together at first; but gape and shrink from each other when dried. In like manner bowls, and other wood-work, crack and

* What this internal spirit is, see below Sect. XI.

split with dryness; whilst the parts contract themselves, and thus of necessity leave empty spaces between. Secondly, this appears from the wrinkling of dry bodies: the endeavour of contracting themselves being so forcible as to bring the parts together, and raise them up; for whatever is contracted in the extremities must rise up in the middle, as we see in paper, parchment, the skins of animals, and in the coat of soft cheese: all which grow wrinkled with age. Thirdly, this contraction appears still more remarkably in such things as do not only wrinkle, but twist, curl up, and roll themselves round with heat; as parchment, paper, and leaves do when exposed to the fire: for contraction, through age, proceeding but slowly, generally produces wrinkles; whilst contraction by the fire, being sudden, causes curling. But in many bodies where neither wrinkling nor curling can happen, there ensues a bare contraction, shrinking, hardness, and dryness, as we first observed. But if the spirit be so far exhaled, and the moisture so consumed, as not to leave enough of the body to unite and contract itself, then all contraction necessarily ceases; the body becomes rotten, and no more than a heap of dust, clinging together, which is dissipated by a slight touch, or thrown off into the air; as we see in all bodies greatly consumed; viz. paper and linen, burnt to the ut-

most; and in dead bodies embalmed after lying many ages.

It must be observed that fire and heat only dry by accident; for it is their proper office to attenuate and dilate the spirit and the moisture: but it follows by accident, that the other parts contract themselves, either to prevent a vacuum, as the vulgar phrase is; or by the concurrent action of some other motion, about which we are not now enquiring.

It is certain that putrefaction, as well as arefaction, has its origin from the native spirit; though it proceeds in a very different way: for, in putrefaction, the spirit not being simply discharged, but in part detained, has strange operations and effects; whilst the grosser parts also suffer, not a local contraction, so much as a joint and homogenious union.*

SECT. IV.

THE HISTORY OF THE LENGTH AND SHORTNESS OF LIFE IN ANIMALS; PURSUANT TO THE THIRD ARTICLE OF THE TABLE OF ENQUIRY.

WITH regard to the length and shortness of life in animals, the information procurable is but

* See the article *Putrefaction*, in the Sylva Sylvarum.

slender, observation slight, and tradition fabulous. Tame creatures are corrupted by a degenerate life; and wild ones intercepted by the inclemency of the weather. Neither do the things which may seem concomitant assist us much in this enquiry; as the bulk of the body, the period of gestation, the number of young, the time of growth, &c. these being complicated considerations, that sometimes concur and sometimes not.

The age of man, so far as can be collected from certain history, exceeds that of all other animals, excepting a very few; and the concomitants in him are found tolerably equable: his size and stature large, his period of gestation nine months, his offspring generally single, his time of puberty at fourteen, and his growth reaching to twenty years.

The elephant certainly exceeds the ordinary age of man; their period of gestation is not ten but two years, or at least above one; their bulk vast; their growth till thirty; their teeth exceeding strong: their blood is observed to be the coldest of all animals; and they sometimes live two hundred years.*

Lions are thought to be long lived, because many of them have been found toothless; but

* See the account of elephants, in the Philosophical Transactions.

this is no certain sign, as it may proceed from their corrupt breath, or other cause.

The bear is a great sleeper, and a sluggish indolent creature, yet not observed to be long lived; they should rather seem to be short lived, from their very short period of gestation, scarce reaching to forty days.

The fox seems well provided for long life; as being well covered, carnivorous, and living under ground; yet he is not observed to be long lived: doubtless he is of the dog-kind, which is but short lived.

The camel is long lived; a lean sinewy creature, that commonly reaches to fifty, and sometimes to a hundred.

The horse shares a middle life, scarce attaining to forty, and usually not to more than twenty; but this shortness of life he probably owes to man: for the breed of the sun is now no more, that ranged at large in fresh pasture; yet the horse continues growing till six, and generates in old age. The mare also goes longer with young than the woman; and but seldom foals double. The ass has nearly the same age as the horse: but the mule is longer lived than either.

The stag is vulgarly famed for long life; but upon no certain history. There goes a report of a certain stag found with a chain about his neck, buried in fat. That he should be a long lived

creature seems less probable, because he comes to his full growth at five; soon after which his horns, which are yearly shed and renewed, grow from a narrower basis, and less branching.

The dog is a short lived creature, that lasts not above twenty years; and seldom sees fourteen: he is hot, and lives unequably; as being often in violent motion, and often sleeping. The bitch has many young ones at a litter; and goes with them nine weeks.

The bull or ox is very short lived for his size and strength, scarce exceeding sixteen years; though somewhat more lasting than the cow. She has seldom more than one calf at once; and goes about six months. This is a sluggish and fleshy creature, that easily grows fat, and feeds wholly upon herbage.

Sheep seldom live to ten, though a creature of a moderate size, and well covered; and though sharing but a very small proportion of gall, yet their coat is exceedingly curled, beyond that of any other animal. The ram generates not till the third year; and continues fit for generation to the eighth. The ewe continues to bear as long as she lives. It is a creature subject to disease, and seldom lives out its full course.

The goat approaches the sheep in age, and almost every thing else; though a more nimble creature, and of a somewhat firmer flesh; whence

he should seem longer lived: but he is much more salacious, and therefore shorter lived.

The hog sometimes lives to fifteen or even twenty; and though its flesh be the moistest of all animals, yet this seems to contribute nothing to the prolongation of life. But for the wild boar, there is no certain account of him.

The age of the cat terminates between six and ten; a nimble creature, abounding in spirit, that eats voraciously, and swallows without much chewing.

The hare and rabbit scarce last seven years: they are both great breeders, and have many young at once. They differ in this, that the rabbit lives under ground, and the hare above; and, that the flesh of the hare is the darkest.

Birds fall far short of quadrupeds in bulk of body: an eagle, or a swan, being but little things compared to an ox, or a horse; or an ostrich compared to an elephant.

Birds are well covered; for feathers exceed wool and hair in point of warmth, and sitting close to the body.

Though birds have many young at once, yet they go not with them together, but lay their eggs at several times; whence the chick receives a more copious nourishment.

Birds masticate but little, if at all; whence their aliment is often found whole in their crop;

yet they will break the shell of a nut, and pick out the kernel.

The flight of birds is a mixed motion, compounded of the motion of the limbs and that of carriage; which makes a very wholesome kind of exercise.

It is well observed by Aristotle, as to the production of birds, that the male seed contributes little to their generation; but supplies rather activity than matter: whence an egg productive of a chick is, in many respects, undistinguishable from one that is not.

Most birds come to their full growth the first year, or soon after: their age is reckoned by the the feathers in some, and by the beak in others; but not by the magnitude of their bodies.

The eagle is accounted long lived; though its years are not observed. And it is esteemed a sign of his long life, that he casts his beak, and thence grows young again: whence the proverb Aquilæ Senectus. But perhaps it is not the renovation of the eagle that casts the beak, but the change of the beak that renews the eagle; for when the beak grows too hooked, the eagle must feed with difficulty.

The vulture is also said to be long lived; so as to last a hundred years. The kite likewise, and all carnivorous birds, and birds of prey, live long. But for the hawk, as she lives a degenerate

and servile life under the falconer, no true estimate can be made of the natural period of her duration: but the tame hawk has been sometimes observed to live thirty years, and the wild one forty.

The raven likewise is said to live long, sometimes to a hundred; a carnivorous bird, not much upon the wing; but rather sedentary, and having very black flesh. But the crow, which resembles the raven, except in size and voice, is somewhat shorter lived.

The swan is certainly found to be a very long lived creature, and often reaches to above a hundred: a bird excellently plumed, that feeds on fish, and delights in running waters.

The goose also is a long liver, but particularly the wild one; though a creature that feeds on herbage; whence the german proverb: older than a wild goose.

Storks must needs be long lived, if the ancient observation of them be just, that they never came to Thebes, because the city was often taken: for, if this were true, they must have had the memory of more than one age, or else the old ones must have taught the young ones history: but fables are endless.

And so much is fable interwove with the history of the phœnix, as quite to bury the truth, if there were any in it; though there is no great wonder

at what they anciently wondered at; viz. that this bird should be alway seen flying with a great attendance of others: for we see the same thing happen to an owl flying by day; or to a parrot that has quitted the cage.

A parrot has certainly been known to live sixty years in England; but how old he was when brought over is uncertain: a bird that feeds promiscuously, that masticates his meat, and casts the beak; being likewise bold, stubborn, and black of flesh.

A peacock lives to twenty; but has not his argus eyes till three years old: a bird of stately step, and whitish flesh.

The dung-hill cock is a salacious, martial, short-lived bird; exceeding brisk, and white of flesh.

The turkey cock somewhat out-lives the dung-hill cock: an irascible bird, and of very white flesh.

The ring-dove is a long liver, and sometimes lasts till fifty: a bird of the air, that sits and builds high; but doves and turtles are short livers, and scarce exceed eight years.

Pheasants and partridges may live to sixteen years; being great breeders, but of more dusky flesh than the pullet kind.

The black-bird is said to be the longest lived of all small birds: a bold bird, and loud of voice.

The sparrow is observed to be very short lived; which is attributed to salacity in the cock: but the linnet, a bird no bigger in body, is observed to live twenty years.

Of the ostrich we have no certain account; those bred amongst us have not been found to live long: and as to the Ibis, she is only recorded for a long liver, without mentioning her time.

The lives of fish are known with more uncertainty than those of land animals; as being less observed on account of their living under water: most of them are without respiration; whence their vital spirit is more pent in; and therefore, though they refresh themselves by their gills, yet that kind of cooling is not so constant as by breathing.

As they live in water, they escape the dryness and depredation caused by the external air; but, no doubt, the surrounding water which enters, and is received into the pores of their bodies, proves more prejudicial than air.

Their blood is said to have very little heat; some of them are very voracious, and prey even upon their own species: their flesh is softer, and less tenacious than of land animals; but they fatten in an extraordinary manner, so that an incredible quantity of oil is afforded by the whale kind.

Dolphins are reported to live about thirty years; the experiment having been tried by cutting off the tails of some of them, and they continue growing till ten.

They report a strange thing of some fish, that after a certain age their bodies waste greatly, while their heads and tails remain of the former size.

The muræna was observed, in Cæsar's fish-ponds, to live sixty years; and by long use this kind of fish was made so tame, that Crassus, the orator, bewailed the loss of one of them.

The pike is found much the longest liver of all fresh-water fish, sometimes continuing for forty years: a voracious fish of prey, whose flesh is firm and dry.

But the carp, the bream, the tench, the eel, &c. are not thought to live above ten years.

The salmon is quick of growth, but short lived; so is the trout; but the perch grows slow, and lives longer.

As to the life of whales, and the like fish of vast bulk, we have no certain account; nor of the sea-calf, the sea-hog, and innumerable other kinds of fish.

The crocodile is reported to be very long lived, and also to have an extraordinary period of growth, insomuch that this is held the only

animal which grows as long as it lives: it is an oviparous creature, voracious, cruel, and well defended against the water. But for any kind of shell-fish, we find no certain account of their length of life.*

LARGER OBSERVATIONS.

It is difficult to discover any rule of the length and shortness of life in animals, as well through a neglect of observations, as the complications of causes.

There are more birds than quadrupeds found to be long lived, as the eagle, the vulture, the kite, &c. though they attain their full growth in one year, and are less of body. Doubtless their plumage is an excellent covering against the inclemency of the seasons; and as they chiefly live in free air, they are like the inhabitants of clear mountains, who prove long lived. Their motion also, in their flight is less fatiguing, less shaking, and more wholesome. Nor do the first rudiments of birds suffer any compression or want of aliment in the uterus of the female. But the principal reason seems to be, that birds are ra-

* If it were essential to the present enquiry, it might be possible to procure a somewhat more exact and particular account of the several creatures above mentioned, as also of several others omitted.

ther formed of the substance of the female than the male, whence their spirit is not so hot and fretting.

It may well be supposed, that the animals made more of the substance of the female than the male are longest lived; and that such as are longest gone with, will participate more of the substance of the female than the male, and are therefore longer lived: whence, in conformity with some observations of our own, we judge, even among men, that those children which resemble the mother live the longest; and so again, the children of old men, begotten upon young wives, provided the father was sound or no way distempered.

The beginnings of all things lie most open both to injury and assistance; so that a less degree of compression, and a larger supply of nourishment to the fœtus in the uterus, must naturally conduce much to the prolongation of life; and this happens either when the young is excluded at different times, as in birds which are oviparous, or when the birth is single, as in animals that have only one young at once.

A long continuance in the uterus contributes three ways to the prolongation of life. First, as the fœtus hence receives more of the substance of the female. Secondly, as it comes forth more strengthened and confirmed. And thirdly, as it

later feels the predatory force of the air. It also signifies that the periods of nature are performed in greater revolutions. And although lambs and calves, which remain but about six months in the uterus, are short lived; yet this proceeds from other causes.

Creatures that feed upon simple herbage, are of short duration; but those that feed on flesh, or seeds, and fruits, as birds, are of a longer; for, even deer, derive one half of their food from above their heads: and the goose, besides grass, finds something in the stubble-fields, and the water.

We judge, that the covering of the body greatly conduces to prolong life; for this wards off, and prevents those unfriendly assaults of the air which, otherwise, strangely undermine and destroy the body: and birds are thus admirably fenced by their plumage. But that sheep, which are also well covered, are of short duration, must be imputed to the diseases whereto that creature is liable; and to their feeding chiefly upon grass.

The head is, doubtless, the principal seat of the spirits; and though this be vulgarly said only of the animal spirits, yet it holds equally of them all: and no question but the spirits greatly prey upon, and consume the body, so that both a greater quantity, or a greater acrimony and sharpness thereof must greatly shorten life: whence

we judge it a principal cause of longevity in birds, that they have such little heads in proportion to their bodies; and conjecture, that such men as have large skulls are shorter lived than others.

The motion of carriage we judge to excel all others for the prolonging of life; now all water-fowl, as the swan, &c. have this motion; so have all birds in their flight, though every now and then mixed and compounded with a brisk motion of the limbs: so again have fish; though as to the length of their life we have no certainty.

The creatures perfected slowest are most lasting; for this shews that nature finishes her periods by greater revolutions; which holds not only of growth, but of other degrees of maturity: so man first puts forth teeth, afterwards the signs of puberty, then the beard, &c.

The timorous animals are not long lived; as the sheep, the pigeon, &c. for the bile is the spur to many functions in the body.

The creatures whose flesh is dark-coloured, are longer lived than those whose flesh is white; as indicating the juices of the body to be more compact, and less dissipable.

In all corruptible bodies, quantity has a great tendency to the preservation of the whole; a great fire is not soon quenched; a small quantity of water is soon evaporated; a branch withers faster than the trunk of a tree; and therefore,

in general, as to species, though not to individuals, the larger animals are longer lived than the smaller, unless some other powerful cause intervene.*

SECT. V

THE HISTORY OF ALIMENTATION, AND THE PROCESS OF NUTRITION, WITH REGARD TO THE FOURTH ARTICLE OF THE TABLE OF ENQUIRY.

All aliment should be of an inferior nature, and a more simple substance than the body intended to be nourished: plants are fed by earth and water, animals by plants, and men by animals. There are also other carnivorous creatures; and man himself makes plants a part of his food: but men, and other carnivorous animals, are difficultly nourished by plants alone; though perhaps they might, by long use, with fruits and seeds that had felt the fire; but not by

* These observations are a kind of deep physical corollaries, sagaciously drawn from the preceding facts, or history of nature; and should be understood as so many first attempts at a just interpretation of nature, with regard to the present subject.

leaves or herbage; as the order of the Folietani experienced.

But too near an approximation, or similarity of substance betwixt the aliment and the body to be nourished succeeds ill; for creatures that feed on herbage, touch no flesh: few carnivorous animals eat the flesh of their own species; and canibals themselves do not ordinarily feed upon human flesh, but either fall into this appetite through depraved custom, or a desire of revenging themselves upon their enemies. A field is not sown to advantage with the grain itself yielded; nor a tree successfully engrafted with its own shoot.

The better the aliment is prepared, and brought somewhat nearer in likeness with the substance to be repaired, the better vegetables thrive, and animals fatten: for a shoot planted in the earth is not fed so well as when grafted on a stock agreeable to its nature; where it finds its nourishment ready digested and prepared. And it has been lately discovered, that the slips of wild trees; as of the elm, the oak, the ash, &c. yield a much larger foliage by incision, than without it. Men also are not so well nourished with raw flesh, as with that prepared by fire.

Animals receive their nourishment by the mouth, vegetables by the root; and the fœtus in the mother, by the umbilical cord: but birds,

for a time, are nourished by the yolk of she egg; some part whereof is found in their craws after they are hatched.

All aliment moves principally from the centre to the circumference, or from within, outwards; only trees and plants are rather nourished by the bark, and external parts, than by the pith, and internal: for if but a narrow slip of the bark be peeled off all round the trunk, the tree dies:* and the blood in the veins of animals nourishes the flesh situated below as well as above them.

There are two actions in all alimentation; viz. extrusion and attraction: the former whereof proceeds from an internal, and the latter from an external power.†

Vegetables assimilate their nutriment simply, without excretion; for gums and the tears of trees are rather redundancies than excrements; and fungus's are diseases: but the substance of animals has a greater perception of its like, and is therefore endowed with a principle of rejection; whereby it refuses the useless, and assimilates the useful parts.‡

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* Perhaps this is not confirmed.

† As in the action of the absorbent vessels, and excretory ducts.

‡ What is properly meant by this perceptive principle, may appear from the De Augmentis Scientiarum, Sect. X.

It is a remarkable thing in the stalk of fruit, that all the nutriment, which sometimes produces such large masses, should be compelled to pass through so slender a neck; for fruits never adhere to the trunk or branches without some stalk between.

It is observable that animal seed is uncapable of nutrition, unless it be fresh; whilst the seeds of vegetables remain nourishable for a long time. Shoots however will not grow, unless grafted fresh and green; nor will roots themselves long preserve their vegetative power, unless covered over with earth.

The degrees of nutrition in animals differ with their age; the fœtus is first nourished by the juices of the mother; with milk, after the birth; next with meats and drinks; and in old age, the grosser and higher relished foods are generally the most agreeable.

It has a capital tendency to the present enquiry, with diligence and attention to discover, whether nutrition may not be performed from without; at least otherwise than by the mouth. Baths of milk are used in consumptions, and emaciating diseases; and some physicians judge a degree of nutrition procurable by glysters. Let this be examined to the bottom: for if nutrition could be secured by externals, or otherwise than by the stomach; then the weakness of digestion which

attends old age, might be compensated by such helps; and a renovation be thus procured.*

SECT. VI.

THE HISTORY OF THE LENGTH AND SHORTNESS OF LIFE IN MAN; WITH RESPECT TO THE FIFTH, SIXTH, SEVENTH, EIGHTH, NINTH, AND ELEVENTH ARTICLES OF THE TABLE OF ENQUIRY.

THE Scripture relates that, before the flood, men lived to several hundreds of years; though none of the antediluvians arrived to a thousand. This longevity cannot be attributed to grace, or the sacred lineage; because there are reckoned, before the deluge, eleven generations, and but eight generations of the sons of Adam by Cain; so that the posterity of Cain seems to have been longest lived. This great age however was, immediately after the flood, reduced to an half: though only in such as were born posterior to

* This enquiry seems not hitherto sufficiently prosecuted, to determine with certainty, how far nutrition is procurable by glysters, unguents, baths, impregnated air, &c. Something however we find casually effected in this way; but the thing requires an express set of experiments to measure its force, and reduce it to rule.

the flood: for Noah, who was born prior to it, arrived at the age of his fathers; and Shem lived to six hundred years. But three generations after the deluge, the life of man was reduced to about a fourth of the primitive standard; that is, to about two hundred years.

Abraham lived a hundred and seventy-five years; a couragious and prosperous man. Isaac lived to a hundred and eighty; a man of peace and chastity. And Jacob, a man of troubles and a numerous offspring, held out to a hundred and forty; being patient, mild and subtile. Ishmael, a military man, lived a hundred and thirty years, Sarah, the only woman whose age is mentioned, lived to a hundred and twenty-seven; a woman of beauty and resolution; an excellent mother and wife; no less famous for her frankness than her duty to her husband. Joseph, a prudent and politic man, who suffered affliction in his youth, but afterwards saw great felicity, lived to a hundred and ten years. His elder brother Levi, lived to a hundred and thirty-seven; a revengeful man and impatient of injuries. The son of Levi also arrived at nearly the same age; so did his grandson, the father of Moses and Aaron.

Moses lived a hundred and twenty years; a man of courage, though of great meekness, and slow of speech. Yet Moses himself, in his psalm, declares the life of man to be but seventy years,

and the halest constitution but eighty; which standard seems, in great measure, to have been observed to the present time. Aaron, who was three years older, died the same year as his brother; a man of ready speech, easy behaviour, and somewhat variable. But Phineas, grandson to Aaron, is computed to have lived three hundred years; if the Israelitish war against the tribe of Benjamin, in which expedition Phineas was consulted, happened in the order of time the history relates it: he was a man exceedingly zealous. Joshua, a military man, a great leader, and always successful, lived a hundred and ten years. Caleb was his contemporary; and seems his equal in age. Ehud the judge, seems at least to have been a hundred; as after the victory over the Moabites, the holy-land had eighty years rest under his government: he was a bold and daring man; devoting himself to the service of his people.

Job after being restored to his felicity, lived a hundred and forty years; and had before his affliction children at man's estate: he was a political, eloquent, and beneficent man, and an example of patience. Eli the priest, lived ninety eight years; a corpulent man, of an easy temper, and indulgent to his children. Elisha the prophet, seems to have lived to more than a hundred; as continuing sixty years after the assump-

tion of Elias; yet at the time of that assumption, the boys mocked him by the name of old bald-head: he was a vehement man, severe, of an austere life, and a despiser of riches. Esaiah the prophet, seems to have been a hundred, for he is found to have prophesied through the course of seventy years; but the time he began to prophesy, and the time he died are both uncertain: he was a man of great eloquence, prophesied of the gospel, and was full of the promises of God as to the new covenant.

Tobias the elder, lived a hundred and fifty eight years, and the younger a hundred and twenty seven; both merciful men, and charitable. In the time of the captivity, many of the Jews who returned from Babylon seemed to have been long lived; as they are said to have remembered and bewailed the difference of the two temples, at the distance of seventy years. Many ages after this, in the time of our Saviour, we find Simeon, a man of ninety, full of religion, hope and expectation. At the same time, Anna the prophetess is found to have lived to above an hundred; as having been married seven years, and a widow for eighty-four; whereto must be added the years of her virgin state; and those she lived after her prophesy of our Saviour: she was a holy woman, that spent her days in prayer and fasting.

The accounts we have of the longevity of men in heathen authors are little to be depended on; both because of the fables into which relations of this kind are very apt to run, and the fallacies of calculation. The accounts extant afford nothing remarkable of the Egyptians, as to the point of long life; for their kings who reigned the longest, exceeded not fifty or fifty five years; which is no great matter, as we sometimes find the same in later days. But the kings of Arcadia are fabled to have been exceedingly long lived: indeed the country was mountainous, full of flocks and herds, and productive of wholesome nourishment; but as it had Pan for its tutelar God, so all the things related of it, seem to have been but panical, idle, and fabulous.

Numa, king of the Romans, lived to eighty; a peaceable contemplative man, addicted to religion. Marcus Valerius Corvinus lived to an hundred, there being forty six years between his first and sixth consulship; a man of great valour, and courage, courteous, popular, and always fortunate.

Solon the legislator of Athens, and one of the seven wise men, lived to above eighty; a man of spirit, yet popular, and a lover of his country: he was also learned, yet no stranger to pleasure, and a soft life. Epimenides of Crete, is reported to

have lived a hundred and fifty-seven years; though the relation has somewhat of the prodigy: for he is said to have passed, or slept away fifty-seven of them in a cave. Half an age after this, Xenophanes the Colophonian lived a hundred and two years, or more; for at the age of twenty-five, he left his native country, and travelled abroad seventy-seven years complete; then returned: but how long he lived afterwards is not certain. He was a man as wandering in mind as body, insomuch that his name, by reason of his wild opinions, was changed from Xenophanes to Xenomanes; though doubtless a man of a vast imagination, and breathing nothing but infinity.

Anacreon, the poet, lived to above eighty; an amorous, voluptuary man, and given to wine. Pindar of Thebes likewise lived to eighty; a sublime poet, of a singular genius, and a great worshipper of the gods. Sophocles of Athens arrived to the same age; a lofty tragic poet, wholly given to writing, regardless of his family-affairs.

Artaxerxes, king of Persia, lived ninety-four years; a man of little genius, impatient of weighty affairs, a lover of glory, but a greater lover of ease. At the same time, Agesilaus, king of Sparta, lived eighty-four years a moderate

man, and a philosopher among princes; yet ambitious and a warrior: though no less effective in business than in battle.

Gorgias, of Sicily, lived to a hundred and eight; a rhetorician, a boaster of his knowledge, and one who taught for profit: he was a great traveller, and a little before his death declared he had no accusation to bring against old age. Protagoras, of Abdera, lived ninety years; he likewise was a rhetorician, but professed not arts and sciences so much as civil and political matters; being a great traveller as well as Gorgias. Isocrates of Athens, lived to ninety-eight: he too was a rhetorician, though a very modest man, that appeared not in public, but had his school at home. Democritus, of Abdera, lived to a hundred and nine; a great philosopher, and of all the Greeks the best skilled in physics, or natural philosophy; a great traveller of countries, but a greater still in the works of nature: he was a diligent experimenter; and pursued analogy, rather than observed the laws of disputation. Diogenes, of Sinope, lived ninety years; a man who used great liberty towards others, and tyrannized over himself, chusing a sordid diet, and practising patience. Zeno, of Citium, lived to ninety-eight; a man of lofty thoughts, great subtilty, and a despiser of opinions; yet not troublesome, but rather catched the mind than bound it,

in the manner of Seneca after him. Plato, of Athens, lived to eighty one; a person of courage, but a lover of quiet; sublime of thought and speculative; a polite well-bred man, though rather agreeable and majestic than chearful. Theophrastus, of Eresus, lived to eighty five; a man of graceful eloquence, and a grateful variety of matter, who collected all that was pleasing out of philosophy, without meddling with what was troublesome or disagreeable. Carneades, of Cyrene, a long time after, also lived to eighty-five; a man of a ready eloquence, who delighted both himself and others with a pleasant and agreeable variety of thought. In Cicero's time, Orbilius the Grammarian lived to near an hundred, having been first a soldier, then a schoolmaster; a sharp and austere man, both with his tongue and pen, and no less severe to his scholars.

Quintus Fabius Maximus, continued augur sixty three years; whence he must needs have lived to above eighty; though in the augurship, nobility was more regarded than age. He was a prudent slow man, moderate in all the parts of life, and courteously severe. Masinissa, king of Numidia, lived ninety years, and had a son after eighty-five. He was a bold man, that relied upon fortune, and experienced many vicissitudes of affairs in his youth; but afterwards enjoyed

a continued run of felicity. Marcus Porcius Cato, lived to above ninety; a man of a very hale constitution, both in body and mind; he was severe in speech with his tongue, delighted in faction, took pleasure in agriculture, and was physician to himself and family.

Terentia, wife to Cicero, lived to a hundred and three; a woman that struggled with many calamities; as first, the banishment of her husband, next the difference between them, again with his final misfortune, and with frequent fits of the gout. Luceia must have lived above a hundred years; for she is said to have acted upon the stage during a complete century; playing perhaps, first the part of a child, and at last that of a decrepit old woman. Galeria Copiola, who was both a player and a dancer, was brought upon the stage again, ninety-nine years after her first appearance thereon; not now indeed as an actress, but as a wonder, at the dedication of the theatre by Pompey the Great; and again also at the votive solemnities for the life of Augustus.

There was another actress inferior to her in age, but superior in dignity, who lived, almost to ninety, viz. Livia Julia Augusta, wife to Augustus Cæsar, and mother to Tiberius: for if the life of Augustus were a play, as himself would have it, and desired his friends to clap him as he

died; doubtless Livia was an excellent actress, who could so well suit a dissembled obedience to her husband, with her power and authority to her son. She was an affable, matronal, busy lady, and tenacious of power. Junia, wife to Caius Cassius, and sister to Marcus Brutus, lived also to ninety; for she survived the battle of Philippi sixty four years; she was a woman of courage, happy in wealth, but afflicted with the calamity of her husband, relations, and a long widowhood; though still honoured and regarded.

The seventy-sixth year of our Saviour, happening in the time of Vespasian, is a remarkable year, wherein we find a kind of chronicle of long lives; for in this year there was a taxation, which is a thing that affords the most authentic and just information, as to the ages of men: and in that part of Italy which lies betwixt the Appennines and the Po, there were found a hundred and twenty four men of a hundred years old and upwards; viz. fifty four of a hundred, fifty seven of a hundred and ten, two of a hundred and twenty-five, four of a hundred and thirty; again, four of a hundred and thirty five, or thirty seven, and three of an hundred and forty years old. Besides these, Parma in particular afforded five; three whereof were each a hundred and twenty, and two a hundred and thirty years old; Bruxella

afforded one of a hundred and twenty-five; Placentia, one of a hundred and thirty-one; Faventia, one woman of a hundred and thirty-two; and a town then called Velleiacium, situate on the hills about Placentia, afforded ten, six whereof were aged a hundred and ten, and four a hundred and twenty. Lastly, Ariminum afforded one aged a hundred and fifty, whose name was Marcus Aponius.

To shorten this history, we have here produced, and shall go on to produce no example of an age under eighty. We affix to each person, a very concise and just character or elogy, of the kind that, in our judgment, has some relation to long life, is not a little regulated by men's manners and fortunes. This relation to life is of two kinds; and intimates either that such persons generally prove long lived; or that such, though less disposed thereto, may yet sometimes live long.

Among all the Roman and Grecian emperors, together with those of Gaul and Germany, down to our own age, containing a list of about two hundred princes, there are found but four who arrived at the age of eighty. To these may be added, the two first emperors, Augustus and Tiberius; the latter whereof lived to seventy-eight, and the former to seventy-six; though both of them perhaps might have lived to eighty, but for

Livia and Caius. Augustus, was a man of a moderate temper, though earnest in the dispatch of business; in other respects, calm and serene; temperate in his diet, but profuse in venery, and happy in all things. In the thirtieth year of his age, he suffered a severe and dangerous illness, insomuch that his life was despaired of; but Antonius Musa, his physician, when the rest had applied hot remedies for the distemper, cured him by the application of cold ones; which, perhaps, was of service in prolonging this emperor's life. Tiberius was a man of slow jaws, as Augustus called him, being slow, though powerful in speech: he was cruel, a drinker, and made lust a part of his regimen; yet took great care of his health, and was used to call that man a fool, who after thirty consulted a physician. Gordianus the elder, lived eighty years, and at last died a violent death, before he was well seated in the empire; a couragious, magnificent, learned man, and a poet; and till the time of his death enjoyed a constant course of happiness. The emperor Valerian lived seventy six years, before he was taken prisoner by Sapor king of Persia; after his captivity he lived seven years in the midst of reproaches, and at length died a violent death; a man of an ordinary capacity, effeminate, but lifted up by popular breath, and failing in performance. Anastasius, sir-

named Dicorus, lived eighty years; a man of a peaceable mind, but abject, superstitious and timorous. Anicius Justinianus, lived eighty-three years; a man desirous of glory, yet indolent in his own person, but happy and eminent in the conduct of his leaders; he was uxorious, not his own master, but led about by others. Helena Britanna, the mother of Constantine the Great, lived to eighty; a woman that intermeddled little in civil affairs, neither in the reign of her husband or son, but given wholly to religion; yet of a great mind, and always happy. Theodora the empress lived to above eighty; a woman of business, that delighted in governing: she was exceeding fortunate, and thence credulous.

To proceed from secular princes, to the heads of the church. St. John the apostle, and beloved disciple, lived ninety three years, and is thence justly denoted by the emblem of the eagle, (breathing nothing but what is divine, and appearing like a seraph) among the apostles, by reason of his fervent charity. St. Luke the evangelist lived eighty four years, an eloquent man, and a traveller; the inseparable companion of St. Paul, and a physician. Simeon the son of Cleophas, called the brother of our Lord, and bishop of Jerusalem, lived an hundred and twenty years; and then too cut short by martyrdom; he was a couragious and constant man, full of

good works. Polycarp a disciple of the apostles, and bishop of Smyrna, seems to have lived above a hundred years, though taken off by martyrdom; a man of a great soul, heroic patience, and indefatigable diligence. Dionysius the Areopagite, who was contemporary with St. Paul, seems to have lived ninety years; he was called the bird of heaven, from the high flight of his theology; and was as remarkable for works as for contemplation. Aquila and Priscilla, first the entertainers, and afterwards the assistants of St. Paul, lived together in happy and memorable wedlock, to the age of at least a hundred; for they were surviving under Xystus the first; a noble pair, and of diffusive charity. St. Paul the hermit, died at a hundred and thirteen: he lived in a cave upon such simple and coarse diet, as should seem scarce able to support life; he spent his whole time in contemplation and soliloquy; though he was not illiterate but learned. St. Anthony the first founder, or, as some say, the restorer of the order of monks, lived to a hundred and five; a devout contemplative man, yet versed in civil affairs; his kind of life was austere and hard, though he lived in no inglorious solitude, nor without some sway; having his monks under him, and receiving the visits and homage of christians and philosophers. St. Athanasius lived to above eighty; a man of in-

vincible constancy, and always triumphant over fame; never yielding to fortune: he was generous to those in power, he kept in the good graces of the people, and was a great master in party disputes, wherein he engaged with uncommon heat and vigour. St. Jerom, according to the more general opinion, lived to above ninety; a fine writer, and of manly eloquence; skilled in the sciences as well as languages: he was also a traveller, and lived austere in his old age, bearing a great spirit in private life, and shining diffusively from obscurity.

Two hundred and forty one popes of Rome have now succeeded to the chair; of which number only five are found to have lived up to eighty years; but martyrdom shortened the natural lives of many of the primitive bishops. John the twenty third pope lived ninety years; a man of a restless spirit, studious of novelties, and making many innovations, some for the better, and many for alteration's sake: amassing together great wealth and riches. Gregory, called the twelfth, created pope in schism, and a kind of interregnum, lived to ninety; but the shortness of his papacy leaves us no more of his character. Paul the third, lived eighty one years; a man of a calm mind and deep knowledge: he was also learned, an astrologer, and had a great regard

to his health; but was, like old Eli, over indulgent to his family. Paul the fourth, lived eighty three years; a man of a rough and austere temper, of a high imperious spirit, passionate, but eloquent, and ready of speech. Gregory the thirteenth also lived to eighty-three; a truly good man, sound both in mind and body, political, temperate, full of good works and charity.

The Essenes among the Jews are commonly said to have lived above a hundred years; a sect that used a very simple diet, according to the Pythagorean rule. Appollonius Tyanæus lived more than a hundred years; a man for such an age, of a graceful aspect: he was doubtless a wonderful person, and held by the heathens for divine, but for a magician by the christians; he was a Pythagorean in his diet, a great traveller, lived in reputation, and was worshipped as a deity; but towards the close of his life, he was accused and reviled, though he still escaped safe to the last. His grandfather also lived to a hundred and thirty. Quintus Metellus lived to above a hundred; and after having happily gone through several consulships, he was in his old age made Pontifex Maximus, and officiated accordingly for two and twenty years, without any faultering of the voice, or trembling of the hand. Appius Cœcus lived to a very great age, though

his years are not recorded; the greater part whereof he passed in blindness, though without being dispirited; but still manfully governing a numerous family, a great dependance, and the commonwealth itself. In the extremity of his age he was brought to the senate in a litter, and was strenuously against the making peace with Pyrrhus; and upon that occasion delivered his speech, the beginning whereof is exceedingly remarkable, and shows an invincible spirit and strength. Hiero, king of Sicily, in the time of the second Punic war, lived almost to a hundred; a man moderate both in his manners and government, a worshipper of the gods, a religious preserver of friendship, beneficent, and always fortunate. Hippocrates, the famous physician of Cous, lived to a hundred and four, and thereby approved and recommended his art; a man of prudence and learning, attached to experience and observation; not endeavouring at words or methods, but barely separating and laying down the sinews of science. Asinius Pollio, friend of Augustus, lived a hundred years; a man of great luxury, but eloquent, and a lover of letters; yet vehement, haughty, cruel, and seeming born wholly for himself. There goes a current report of Seneca, that he lived to a hundred and fourteen, but this cannot be true; for so far from be-

ing a decrepit old man when promoted governor to Nero, that he was then extremely fit for business; and but a little before that, in the reign of Claudius, was banished for adultery with certain ladies of the first rank; a crime not suitable to such an age. Many of the Venetians are found to be long lived, even among their nobles; as the duke Franciscus Donatus Thomas Conterenus, and Franciscus Molinus, both of them procurators of St. Mark: but the most remarkable instance is, that of Cornaro the Venetian, who being a valetudinarian, at first began to eat and drink by weight and measure, for the sake of his health, which brought him by degrees to a certain diet; and this diet to a very long life, even that of a hundred years and more, with the entire use of his senses, and a constant course of health. And in our time, one Postel a Frenchman, lived almost to a hundred and twenty; the extremity of his beard, on the upper-lip, growing dark, not at all grey: the man was disordered in his senses, a great traveller, a mathematician, and somewhat heretical.

Amongst us, in England, perhaps there is no populous village wherein a man or woman of eighty may not be found. A few years since, at a wake in Herefordshire, there was a dance performed by eight men, whose ages put together

made up eight hundred years; for so much as some of them fell short of a hundred, others exceeded.*

In Bethlem-hospital, in London, destined to the reception of lunatics, there are found, from time to time, many distracted persons long lived. And so much for the history of longevity in man, with regard to individuals. We next proceed to collective or general observations.

The succession of ages, and of the generations of men, seems no way to shorten the length of human life: since the age of man down from Moses's time to the present, has stood at about eighty years, without gradually declining, as one might have expected. But, doubtless, there are times in every country, when men live to a longer or a shorter term; and they generally prove longest lived, when the times afford but a simple diet, and give greater occasion to bodily exercise; and shortest lived, when the times are more polite, or abound in luxury and ease: but these things have their changes and revolutions; whilst the succession of mankind holds on, uninterrupted, in its course. And, no question, but

* This history might be continued a century lower, with an account of many memorable persons of both sexes, who have lived to above fourscore, and some to above an hundred; particularly such as old Parr, Jenkins, &c.

the case is the same in other animals; as neither oxen, horses, sheep, &c. have had their term of life shortened in the latter ages; and therefore the lives of creatures, it should seem, were at once abridged by the deluge. And the like may happen from other grand accidents; as particular inundations, long continued droughts, earthquakes, &c. This observation seems likewise to hold with regard to the size or stature of the body, which alters not with the succession of generations; though Virgil, following the common opinion, predicted posterity should diminish in their size.* For though, it is certain, there have antiently been men of a gigantic stature; as appears from their remains found in Sicily and elsewhere, in antiques, sepulchres, monuments, and caverns; yet there has no such thing been continued in the same places for these three thousand years, of which we have any authentic account:† though this matter likewise is subject to revolutions and changes, through the manners and civil customs of men, no less than the former. The more regard should be had to these observations, because men are possessed with a notion, that the age of the world is constantly upon the decline,

* Grandiaque effossis mirabitur ossa sepulchris.

† And possibly the bones here mentioned might be the bones of elephants, not of men.

both as to the length of life, and the size and strength of the body; and that all things decay and tend to the worse.

In the cold northern countries men generally live longer than in hot ones; which happens from hence, that the skin of the body is there more constringed, the juices of the body less dissipated, the spirits themselves less sharp and predatory, or more easy to repair; and the air, as being but little heated by the sun, less consuming. Under the equinoctial however, where they have a double winter and a double summer, and a greater equality in the spaces of day and night, they live to a considerable age, if nothing else prevent it; as in Peru, Ceylon, &c.

The inhabitants of islands are generally longer lived than the inhabitants of continents; for the people of Russia live not so long as those of the Orcades; nor those of Africa under the same parallel, as those of the Canaries: the Japanese, also, are longer lived than the Chinese, though the latter are extravagantly fond of long life. The cause seems to be this, that the sea-breezes warm in cold climates, and cool in the hot.

Lofty situations are more conducive to long life than low ones; especially if not upon the tops of mountains, but upon high lands as to the situation in general; such as Arcadia in Greece, and part of Ætolia; where the inhabitants were

very long lived. And the case would be the same in mountains themselves, on account of their pure and clear air, if not accidentally affected by the vapours, rising from the vallies, and hanging about all mountains. Whence the inhabitants of snowy mountains are not very long lived: as in the Alps, the Pyreneans, and the Apennines; but all middle sized hills, and in vallies also, men are found to live longer. Again, on the tops of the mountains running towards Æthiopia and the Abyssines, men lived to a very great age, and, at this day, often to a hundred and fifty; for here, by reason of the sands at the bottom, little or no vapour can rise up to the top of the mountains.

Marshy, and fenny lands, especially those lying upon a flat, suit better with the natives than with strangers, as to the prolonging, or shortening of life: and what seems strange, the salt marshes, which are, at certain seasons, overflowed with sea-water, prove more unwholesome than the fresh.

The particular countries remarkable for long lived inhabitants, are Arcadia; Ætolia; India, on this side the Ganges; Brazil; Ceylon; Britain; Ireland; the Orcades, and our Western Islands.

The wholesomeness of the air, especially in a perfect degree, is a secret, and concealed thing;

discoverable rather by experiment than by reasoning, and conjecture. Trial hereof may be made, by exposing a fleece of wool to the air, for some days; to see if it loses little of its weight. Again, by observing if a piece of flesh will continue long in the air uncorrupted: and again, if the weather-glass plays within a small compass. But of these, and the like experiments, let farther enquiry be made.*

Not only the goodness, or purity, but also the equality of the air, has regard to long life. The intermixture of hills and vallies, though pleasing to the sight and the sense, may be held suspect as to lengthening of life; but a moderately dry plain, neither too barren, nor totally without trees and shade, is better suited to procure longevity.

Inequality of air is prejudicial in a mansion place; but the change of air in travelling, after being accustomed to it, is serviceable: whence many great travellers have proved long lived. So likewise, such as dwell continually in the same little cottage, without change of place, are long lived; for that air consumes less to which the body is accustomed; but change of air nourishes and repairs more.

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* See the author's Sylva Sylvarum, under the articles, *Air, Plague*, &c.

Though the revolution and number of successions conduce nothing to the length, or shortness of life, as we observed above; yet the immediate state of the parent, both on the side of father and mother, must, doubtless, greatly regard it. Thus some beget children when they are old, others when young; some at a proper age; some when unsound, and ill disposed; some when morbid and languid; some when full, and in liquor: some after sleep, and in the morning; some after a long intermission, or frequent repetition of the conjugal act; some in the heat of a love-fit, which is commonly the case of a spurious issue; and some again, when the edge of love is taken off, as after long cohabitation. And the like particulars hold also of the mother; whereto may be added her state whilst she goes with child, her health and diet, together with the time, or month, she goes to. It is a difficult thing to reduce all this to rule, with regard to longevity; the more so, because what a man might judge for the best, may happen to prove the worst: so that alacrity in generation, which produces children of a robust and active body, may contribute less to lengthen life, from the acrimony and inflammation of the spirits attending it.

We before observed, that a large participation of the mother's juices contributes to the longevity

of the child: in other respects we judge moderate things the best; conjugal affection, better than loose; the morning better for generation; the state of the body, not over full, or vigorous, &c. It must also be well observed, that the robust habit of the parents, makes better for themselves than for the child, especially in the mother. Plato therefore judged, unskilfully, that the power of generation was defective, because the woman did not use the same exercise of mind and body as the man: for a difference of powers, between the male and female, is of greatest service to the child; whence women, and nurses, of a delicate and tender constitution, supply the best and most plentiful nourishment to the fœtus, and the child. Nor were the children of the Spartan women, who married not before the age of twenty-two, or, as others say, twenty-five, finer, or longer lived, than those of the Roman, Athenian, or Theban women, who were marriageable at twelve or fourteen. And if the Spartans had any great advantage, it was more owing to their sparing diet, than to the late marriage of their women. Lastly, it is manifest from experience, that certain races of men are long lived for a season; insomuch that longevity, as well as distempers, may be hereditary and periodical.

Persons pale in the face, skin, and hair, are not long lived; but such as are brown, red, or freckly, prove more lasting. Too fresh a colour in youth, is not so good a sign of long life as paleness. A hard skin denotes a longer life than a soft skin: but this is not meant of a thick, or goose-skin, which seems spongy; but of one that is both hard and close. So likewise a forehead with large wrinkles, is a better sign than one that is smooth.

Hard bristly hair denotes a longer life than such as is soft and weak; so likewise does curled hair, especially if harsh, promise better than such as is soft and glossy: so again, does hair, thick and short-curled, better than that in larger rings.

Baldness, coming early or late, is a thing indifferent; for numerous bald men have proved long lived: and even greyness, happening early, is fallacious; for many that were soon grey, have lived long after it; nay, to grow grey before the time, without growing bald, is a sign of long life, though not, if attended with baldness.

Hairiness on the upper part of the body, is a sign of short life; and those extraordinary hairy on the breast, are not long lived: but hairiness on the lower parts, as the thighs and legs, denotes longevity.

Tallness of stature, if not excessive, and the body be well set, but not thin, especially if attended with agility, is a sign of long life: as, on the other hand, men of a short stature, and slow of motion, live not so long.

As to proportion: they who are short in the body, but long in the legs, live longer than those who are tall in the body, but short in the legs. And again, those who are of a large make below, but slender upwards, the body thus rising as it were conical, are longer lived than those who are broad shouldered, and squeezed in below.

Leanness, where the passions are calm and the temper easy, and a full habit, where the passions prove more vehement, are signs of long life: but corpulency in youth, denotes shortness of life; though in old age it is a thing more indifferent.

For growth to continue long and gradual, is a sign of longevity; and if it produce a large stature, the sign is great; but smaller, if a less: as, on the contrary, sudden growth to a large stature, is a bad sign; but if to a short one, less bad.

Firmness of flesh, plump muscles and sinews, a smallness of buttock, and a rising of the veins, denote long life; and the contrary a short one.

A small head in proportion to the body, a moderate neck neither long nor scraggy, full, nor short, nor as it were buried in the shoulders;

wide nostrils, whatever be the form of the nose; a large mouth; an ear gristly, not fleshy; teeth strong, close joined, not small, or thin set; all these are signs of long life; and so much the more if any new teeth shoot out in advanced age.

A wide chest, rather sunk in than prominent; round shoulders; a flat belly; a large hand with but few lines in the palm; a short round foot; a thigh not over fleshy; and a firm calf; are signs of long life.

A large eye, with the iris greenish; the senses not over quick; a pulse slow in youth, but quicker as age comes on; an ability of holding the breath long; costiveness in youth; and laxativeness in age; are also signs of long life.

There has been nothing remarkable observed of the times of nativity with regard to long life, except what is astrological; which is a consideration we here meddle not with; though it finds a place in our tables of enquiry. A birth at eight months' end is so far from being long lived, that it is scarce thought capable of rearing. And children born in the winter, are accounted longest lived.

A Pythagorean or monastic diet and life, led conformable to strict rules, and always exactly equable, like that of Carnaro, seems a thing of great power in the prolongation of life. On the contrary, of such as live freely, and in the com-

mon way, those are frequently found to live the longest that eat and drink to the full, or use a liberal table. A moderate or temperate diet is recommended, and indeed contributes to health, but has little efficacy in prolonging life; for the strict regimen supplies few spirits, and those sluggish; whence it consumes the less; whilst the full diet affords a more copious nourishment, and therefore recruits the more: but the moderate one does neither. Indeed where extremes are hurtful middle courses prove the best; but where extremes are serviceable,, moderation is of little significance. The strict regimen requires watching, otherwise the few spirits may be oppressed by much sleep; it requires little exercise to prevent their wasting; and an abstinence from venery, lest they should be exhausted: but the full diet suits best with full sleep, frequent exercise, and a seasonable use of venery. Bathing and anointing conduce more to pleasure than the prolongation of life. But we shall speak more closely to all these heads, when we come to enquire of intentions* with a view to practice. In the mean time, the advice of Celsus, who was not only a physician, but also a learned and wise man, should not be slighted, when he directs a variety and change of regimen; though still with the ad-

* See hereafter, Sect. viii.

vantage to the more grateful side: for example, that a man should sometimes accustom himself to watching, and sometimes indulge himself in sleep, but oftenest the latter: That he should sometimes fast and sometimes eat freely, but oftenest the latter: and that sometimes he should strongly employ, and sometimes slacken the faculties of his mind; but oftenest slacken them. Doubtless a well regulated diet has a principal share in the prolongation of life; nor have I ever yet met with a man of any great age, who did not, when he was asked, say he observed a certain peculiarity in his diet; some one thing, others another. And I remember an old man of above a hundred, produced as a witness upon an ancient prescription, who, when he had given in his evidence, being familiarly asked by the judge what course he took to live so long? unexpectedly replied, with the laugh of the audience, by eating before he was hungry, and drinking before he was dry.

A life spent in religious duties and offices, seems conducive to longevity: This kind of life is attended with ease, admiration, the contemplation of divine matters; noble hopes, wholesome fears, pleasing melancholy; continual renewals, by observances, penances, and expiations, without sensual delights; all which conditions have a strong tendency to prolong life.

And if to these be added, the austere diet, which indurates the body, and humbles the spirit; no wonder if it procures a remarkable longevity: like that of Paul the hermit; Simeon the stylite, or Columnar anchorite; with many other anchorites and hermits of the desart.

What approaches nearest to the former, is a life of letters; as that of philosophers, rhetoricians, grammarians, &c. for this also turns upon leisure, and such thoughts, as, little regarding the affairs of life, have no severity; but delight by their variety and impertinence. Men of letters also live to their own wish, and bestow their time upon subjects that please them best; and are commonly in the company of youth, which is more agreeable. But there is a great difference betwixt philosophers, as to prolonging life, in respect of their sects; those being the best for this purpose which have somewhat of superstition, and sublime speculation; as the Pythagorean, and Platonic. So likewise those which ranged the universe, and took in all the varieties of nature, and had clear, noble, and lofty thoughts (as of infinity, the stars, heroic virtues, &c.) were conducive to long life; as the philosophies of Democritus, Philolaus, Xenophanes, the astrologers and the stoicks. Those likewise were proper to this end, that without any deep speculation, or severe enquiry, but on the footing of

common sense, and vulgar opinions, calmly disputed on both sides of the question; as those of Carneades, the academicks, the ancient rhetoricians, and grammarians. On the contrary, the dogmatical philosophers, that turned upon perplexing subtilties, and examined and wrested every thing in conformity to certain principles; and lastly, all the thorny and strait-laced philosophies such as were generally those of the peripateticks and the schools, are bad for this purpose.

A country life is also well suited to procure longevity; as being led much without doors in the open air, not indolently but in action, and generally supported with fresh and unexpensive diet, without envy, without care.

We likewise entertain a good opinion of a military life in youth. Many great leaders have been long lived; as Corvinus, Camillus, Xenophon, Agesilaus, and others, both ancients and moderns. It is doubtless of service to long life when all things, from youth to old age, have a favourable and friendly tendency; so that a youth inured to hardships may alleviate and sweeten old age. We likewise judge that military passions, on the watch for battle and victory, give such a warmth to the spirits as conduces to longevity.

SECT. VII.

OF REMEDIES CONDUCING TO LONG LIFE: WITH REGARD TO THE TENTH ARTICLE OF THE TABLE OF ENQUIRY.

THE art of medicine at present in use, regards little more than the preservation of health, and the cure of diseases; without, or but transiently, taking notice of such things as properly contribute to the prolongation of life. We shall, however, here lay down the medicines in esteem for this purpose; which go by the name of cardiacs: for such remedies as in cures defend and corroborate the heart, or, more properly, the spirits, against poisons and diseases; being judiciously, and with choice, introduced into diet, may very probably also conduce, in some measure, to prolong life. And this we shall do, not in the common way by throwing such medicines in a promiscuous heap; but by selecting out the most eminent.

Gold is exhibited in three forms; viz. that of aurum potabile, as it is called; quenched in wine; and in substance, as in leaf or filings. The aurum potabile began to be given in dangerous or inveterate diseases, as an excellent cordial; and with no despicable success: but we judge,

that the virtue is owing to the spirit of salt, which makes the solution, rather than to the gold itself; though this be studiously concealed. But if the body of gold could be opened without a corrosive menstruum, or by corrosive menstruums without any pernicious quality; provided the solution were afterwards well washed, we judge it might be an useful thing.

Pearls are taken either in levigated powder, or in a magistery or solution, made with the juice of fresh and very tart lemons: they are likewise sometimes given in aromatic confections; and sometimes in a fluid form. Doubtless the pearl has some affinity with the shell it adheres to; and may have a like virtue with the shells of crawfish.

Among the transparent gems there are principally two accounted cordial; the emerald and the jacynth: which are given in the same forms as pearls; excepting that their solutions are not in use, as we know of. But we a little suspect these crystaline gems of roughness; or of wounding the parts like glass.

The bezoar stone is famed for refreshing the spirits, and causing a gentle sweat: but the horn of the monoceros has lost its reputation; though it still continues upon the same footing with hartshorn, the bone of the stag's heart, ivory, &c.

Ambergris is one of the best things for appeasing and comforting the spirits.

For warming and invigorating, are recommended saffron, indian-leaf, lignum aloes, citron-peel, balm, hasil, avens, orange-flowers, rosemary, mint, betony, and carduus-benedictus.

For coolers are recommended nitre, roses, violets, strawberries, both leaves and fruit; the juices of sweet lemons, oranges, and apples; borage, bugloss, burnet, saunders, and camphire.

As we here mention such medicines only as may be introduced into diet, we omit all inflammable distilled waters and chemical oils; and all aromatic, acrimonious, and pungent remedies; only recommending it to mens' consideration, how waters and liquors may be prepared from the preceding ingredients; not in the way of the common phlegmy waters, by the still; nor, again, with ardent spirits; but of a more temperate nature, yet lively, and breathing a friendly vapour.

We are in some doubt as to the frequent use of phlebotomy, whether it conduces to long life, or not; but rather incline to think it may, when grown into a habit; and other things are suited thereto; because it discharges the old juices of the body, and gives occasion to new.

We likewise judge, that a thorough cure of certain emaciating diseases conduces to longevity, as supplying new juices in the room of those consumed; and because, to recover from sickness is in a manner to grow young again, a kind of arti-

ficial diseases might be procured by means of strict emaciating diets: but more of this hereafter.*

SECT. VIII.

THE HISTORY OF INTENTIONS; WITH A VIEW TO THE FORMING OF PRACTICAL RULES FOR THE PROLONGATION OF LIFE; IN PURSUANCE OF THE TWELFTH, THIRTEENTH, AND FOURTEENTH ARTICLES OF THE TABLE OF ENQUIRY.

HAVING now finished our enquiry, with regard to the objects; viz. inanimate, vegetable, animal and human bodies, we must come closer: and conduct the remainder by intentions, which, in our own judgment are just, proper, and, as it were, the real paths of mortal life. But nothing of moment, has hitherto been performed on this head; mens' thoughts about it having all along been trifling and unprofitable. Some talk of comforting the natural heat, and the radical moisture; of foods, that make a laudable blood, neither adust nor phlegmatic; of cooling and refreshing the spirits, &c. And we take them for well-meaning men that talk thus: but all this makes little to the purpose. Another party cries

* See below Sect. VIII. ad finem.

up medicines prepared from gold, as from a body incorruptible; and from gems, for recreating the spirits by their heat and occult properties. They add, that if the balms and quintessences of animals could be received, and contained in vessels, there would be great hopes of immortality: that the flesh of vipers, and of deer, by a certain consent, have a power to renew life; because the one casts the skin, and the other the horns. They likewise abound in still stranger accounts, of an ointment found buried under ground, which a man by using to his whole body, except the soles of his feet, thence lived without any distemper, (except some swellings on the soles of his feet) to the age of three hundred: and that Artefius growing old, transplanted the spirit of a young man into himself; and thus by the death of another, continued alive for many years. Others speak much of successful hours, according to the horoscope of the heavens, for collecting and preparing medicines destined to prolong life; they talk of planetary seals, whereby to bring down and derive celestial virtues for the same purpose; with numerous other the like fabulous and superstitious stories: insomuch that we stand amazed how men should be so infatuated as to believe such absurdities; and cannot help commiserating the hard fate of mankind, in being beset and pressed on all sides with things vain and useless. But for our own intentions, we have hopes that

they close in with things themselves, without any tincture of fiction, vanity, or credulity; and take them to be such, that though numerous particulars may be found by posterity to answer them, yet no great additions can be made to the intentions themselves. But before we proceed, we must offer a few admonitions, of the utmost importance to mankind.

And first we judge, that the offices of life are preferable to life itself; and therefore, though there should be any thing that might better answer our intentions, but with injury to society, we absolutely reject it. Things of this kind we may perhaps mention; but never insist upon. Thus we have no serious and laboured discourse upon men's leading their lives in caves, free from the inclemencies of the air; upon perpetual bathing in prepared liquors; covering the body with adventitious skins, or oil-clothes; daubing it over with a thick coat of paint; the institution of a strict and exact regimen and diet, with no other design than to prolong life; or the like monstrous, nauseous, and incommodious methods: but produce only such remedies and rules as neither disturb the duties and affairs of life, nor clog them with delays and difficulties.

Secondly, we earnestly beseech mankind to trifle no longer, or imagine that so great a work as to stop and turn back the powerful course of nature, should be performed by a morning's-

draught, or the use of a costly medicine; but to hold it for certain, that a work of this kind is a laborious undertaking, which requires a number of remedies, properly suited to each other; for no one surely can be so dull as to believe, that what was never yet done, should be effected but by means never tried before.

We expressly declare, that some of the things we shall propose were never experienced by us; nor would our course of life allow thereof; but that they are derived with great justness, as we judge, from our principles and positions, as parts dug and cut off from the rock or mine of nature: being extremely cautious to propose no remedies but what are at least safe, if not effectual.

We desire men would observe and distinguish, that the same things do not always contribute both to a healthy and a long life; for there are some of service in procuring chearfulness of spirits, strength and vigour of the faculties, and yet shorten the course of life. There are also other things very conducive to long life, though with some danger to the health, unless prevented by suitable means: whereof we shall not omit to give our intimations and cautions occasionally.

We think proper to propose various remedies, suitable to each intention; leaving the choice thereof, and the order of their application, to discretion: since it would be too tedious and im-

proper, to publish particular directions for different constitutions of body, or the various kinds of life, and ages; so as to shew what methods are most agreeable to each; in what order one thing is to be taken after another; and how the whole praxis and regimen is in every case to be conducted and observed.

In our table of enquiry we have laid down three general intentions; viz. The prevention of waste; the perfecting of recruit: and the renovation of decay: but as what we have to propose upon these heads is real matter, not words, we shall draw out the three intentions into ten operations; viz. 1. The operation upon the spirits, with a view to their rejuvenescency. 2. The operation for excluding the air. 3. The operation upon the blood; and the best heat for sanguification. 4. The operation upon the juices of the body. 5. The operation upon the viscera, for protruding the aliment. 6. The operation upon the external parts, for attracting the aliment. 7. The operation upon the food itself, for making it insinuate. 8. The operation upon the last act of assimilation. 9. The operation for mollifying the parts, after they begin to dry. And, 10. The operation for discharging the old juices, and supplying their place with new. The four former relate to the first intention; the four next to the second; and the two last to the third intention.

And as this enquiry of intentions is directed to practice, we shall now comprise experiments, observations, admonitions, remedies, the explanation of causes, positions, and whatever belongs to the subject, under the name of history.*

I.

THE HISTORY OF OPERATING UPON THE SPIRITS; SO AS TO RENEW, AND CONTINUE THEM IN A YOUNG AND VIGOROUS STATE.

THE spirits are the agents and fabricators that produce all the effects in the body; as appears from numberless circumstances.

If new and young spirits could be put into an old body; 'tis probable that this grand wheel might give motion to the rest, and turn the course of nature back.

In all consumption, whether by fire or age, the more the heat or the spirit of the subject preys upon the moisture, the less durable that subject becomes; as is every where plain and obvious.

The spirits are to be put into such a temper and degree of activity, as not to drink and drain, but barely to sip the juices of the body.

There are two kinds of flame, the one brisk

* Observe, that the whole was afterwards intended to be adjusted, recomposed, verified, and improved, according to the directions given in the second part of the Novum Organum.

but feeble; which consumes and evaporates light bodies, as straw or shavings, without much affecting the harder: the other strong and constant; which exerts a force even upon hard and obstinate subjects: as large wood and the like.

A brisk but weak flame dries bodies up, and renders them hard, decayed, and juiceless; and a stronger softens and dissolves them.

Some discutient medicines also breathe out only the thinner parts in tumours, and therefore indurate; whilst others discuss more powerfully, and therefore soften.

So some purging and detersive remedies suddenly carry off the more fluid parts; whilst others draw away such as are more obstinate, and viscous.

The spirits should be possessed of such a heat as fits them rather to prey upon and undermine the hard and stubborn parts, than to discharge and carry off such as are fine and prepared: for by this means the body remains fresh and firm.

The spirits should be so prepared and wrought as to become dense in their substance, and durable in heat, without growing sharp; of such a quantity as suffices for the offices of life without redundancy; and of an easy, equable, and not subsultory motion.

'Tis manifest that vapours have a great effect upon the spirits, from the sleep, the intoxication,

the melancholy and mirthful passions they procure; and the recovery of persons in fainting fits, by odours.

The spirits are condensed four ways; viz. 1. by flight: 2. by cooling; 3. by appeasing; and 4. by quelling. And first for the condensation by flight.

1. Whatever compresses on all sides, drives the body towards its centre, and therefore condenses.

Opium is an exceedingly powerful and effectual remedy for condensing the spirits by flight or compressure; and next to this, other opiates and soporiferous medicines in general.

The virtue of opium is very remarkable for condensing the spirits; as about three grains thereof may presently so congulate or drive them together, that they shall not recover; but be suffocated and rendered immoveable.

Opium and the like medicines, do not put the spirits to flight by their coldness; for they contain parts that are manifestly warm: but on the contrary, cool by putting the spirits to flight.

This flight of the spirits by opium and opiates, appears clearly from the external application thereof: upon which the spirits immediately withdraw themselves, and return no more; but leave the part to gangrenate and mortify.

Opiates give ease in violent pains; as in those

of the stone, or the amputation of a limb; principally by putting the spirits to flight.

Opiates have a good effect from a bad cause: for to disturb the spirits from their seat is bad; but the condensation of them by that disturbance is good.

The Greeks laid great stress upon opiates, both for the preservation of health, and the prolongation of life; and the Arabians still more: insomuch that their capital medicines have opium for the basis and principal ingredient; with the addition of other things to abate and correct its noxious qualities, as in venice-treacle, mithridate, &c.

Whatever is successfully used in the cure of pestilential and malignant diseases, to check and curb the spirits, and keep them quiet, may be advantageously transferred to the prolongation of life; as the same thing, viz. the condensation of spirits, is effectual in both cases: and this end is chiefly procured by opiates.

The Turks find opium, even in a large quantity, innocent and cordial; insomuch that they take it before they go to battle, as a means of inspiring courage: but to us it is mortal, unless in a small dose, and well corrected.

Opium and opiates are found to excite venery; which manifests the power of strengthening the spirits.

The distilled water of wild poppy is successfully given in surfeits, fevers, and many other distempers; being no doubt a mild kind of opiate. And let no one wonder that such a medicine should be used for various purposes; this being the privilege of opiates; because when the spirits are corroborated and condensed they are unable to resist any distemper.

The Turks use a kind of berry called coffee; which they roast, powder, and make into an infusion with hot water. The drinking of this, they affirm, adds strength and vigour both to the mind and body; though when taken immoderately it disorders the senses: whence it appears to be a kind of opiate.

A certain root called betel is celebrated over all the east; the Indians, and others, accustoming themselves to chew and hold it in their mouth; whereby they are wonderfully refreshed, enabled to endure fatigue, throw off disorders, and strengthened for venery. This also seems a kind of narcotic; for it gives a great blackness to the teeth.

The use of tobacco has spread very wide in our time; and gives a secret delight to those who take it; insomuch that the persons once accustomed thereto find a difficulty to leave it off: and doubtless it contributes to alleviate fatigues, and discharge the body of weariness. It is also

commonly said to open the passages; and draw off humours. But its virtues may be more justly attributed to its condensing the spirits; as being a species of henbane; and, like opiates, manifestly disturbing the head.

There are sometimes humours generated in the body, which themselves act like opiates; as we find in some kinds of melancholy, those who are affected therewith proving very long-lived.

The simple opiates, called also narcotics and stupefactives, are opium itself, that is, the exhaled juice of poppy; both the poppies, as well the plant as the seed, henbane, mandrake, hemlock, tobacco, and nightshade.

The compound opiates are the laudanums, venice-treacle, mithridate, diascordium, philonium, the hounds-tongue pill, the storax pill, and diacodium.

From what is before laid down may be deduced certain directions, or rules for the prolongation of life, with regard to this intention of condensing the spirits by opiates.

For example: from the time of full growth, let an opiate diet be instituted yearly, and entered upon about the end of May; because the spirits are most dissolved and attenuated in the summer; and the danger is then the less from cold humours: but let the opiate employed be a commanding one; though weaker than those in

use, as receiving a less proportion of opium, and a more sparing addition of the very hot ingredients. Let it be taken in the morning; sleeping upon it. The diet should, at this time, be simple and sparing; without wine, spices, or any thing sweating. Let the medicine be taken only every other day; and continued for a fortnight. And the design of this rule, in our judgment, duly answers the intention.

Opiates also may be received not only by the mouth, but in the way of fumes; though this should be done in such a manner as not greatly to affect the expulsive faculty, or drain off the humours; but for a short time only, to operate upon the spirits in the brain: and therefore in a morning, a suffumigation of tobacco, mixed with lignum-aloes, dried rosemary, and a little myrrh, received awhile at the mouth and nostrils, may be of service.

For the capital opiates, such as venice-treacle and mithridate, it were proper, especially in youth, to use the distilled waters thereof, rather than the medicines themselves; because the vapour of the medicine rises, and its heat is greatly kept back by distillation; for distilled waters are generally excellent in the virtues that rise by vapour; but poor and weak in other respects.

There are medicines which have a certain feeble, secret, and therefore safe opiate virtue.

These yield a copious, but sluggish, and not malignant vapour, as other opiates do; and therefore put not the spirits to flight, but only collect and somewhat thicken them.

The milder opiates, or substitutes for the stronger, are principally saffron, the Indian-leaf, ambergrease, amomum, pseudamomum, lignum rhodium, orange-flower water; but much rather an infusion of the fresh flowers in oil of almonds.

Though the stronger opiates are to be used but very sparingly, and at certain times; this milder sort may be used common, and in daily diet: and they contribute greatly to prolong life. An apothecary of Calicut, is, by the use of ambergris, reported to have lived an hundred and sixty years; and the nobility of Barbary are, by the use thereof, found to be long lived; whilst the common people there are but short lived. And our ancestors, who made a frequent use of saffron in their cakes, their broths, &c. lived much longer than we do. And so much for the condensation of the spirits by opiates, and there substitutes.

2. We come now to the second manner of condensing the spirits, viz. by cold. And first, condensation is the proper effect of cold; and performed without any malignity or unfriendly quality: whence its operation is safer than that of opiates, though somewhat less powerful, if

only used by turns as opiates are: but as it may be employed familiarly and with moderation ordinarily, it has a much greater effect than opiates in the prolonging of life.

The spirits are cooled three ways; viz. 1. by respiration. 2. by vapour. And 3. by aliment. The first is the principal, but somewhat out of our command; the second also is powerful, and within our compass; but the third is weak and slow.

A clear and pure air that has nothing fulginous, nor felt much of the sun's heat, before it is received into the lungs, excellently condenses the spirits. And such an air is found on the dry tops of mountains, or in open champaigns, that are brushed by the wind, but screened from the sun.

As to the cooling and condensing of the spirits by vapours; we place the foundation of this operation in nitre, as a subject chosen and peculiar to this end, for the following reasons.

Nitre is a kind of cold aromatic, as appears from the sense itself; for it bites and vellicates the tongue and palate with cold, as spices do with heat; and is the only thing that we know of, which has this property.

All cold bodies that are properly, and not accidentally cold, as opium, contain but little, and a jejune spirit; whilst, nearly all the hot bodies are full of spirit. Nitre is the only body in the

vegetable kingdom that, though cold, abounds with spirit; for camphire, which is spirituous, yet performs the actions of cold, refrigerates only by accident; viz. by its tenuity, without acrimony, and by promoting perspirations in inflammations.

In the congelation and freezing of liquors, lately introduced by the application of snow and ice without-side the containing vessel, nitre is used as an ingredient; and doubtless both excites and strengthens the freezing power. It is true, common bay-salt is used for the same purpose; but this rather actuates the cold of the snow or ice, than gives a coldness of itself. But I have been told that in the hotter regions, where no snow falls, congelation has been performed by nitre alone: though this is not hitherto verified.*

Gunpowder, whereof nitre makes the principal ingredient, is reported, when drank, to in-

* I suppose this is meant of the coolness which nitre communicates to water during the time it continues dissolving therein. But does not the act of congelation require salarmonic instead of nitre; and a second or third repetition of the solution, after both the salt and the water have remained in the former solutions, to acquire their degrees of cold respectively? For scarce any salt will produce ice upon being barely dissolved in the water of a warm climate; unless the water be considerably cooled before. See Sylva Sylvarum, under the articles, *Cold, Coolness,* and *Heat.*

spire courage, and to be frequently taken by sailors and soldiers before battle; as opium is by the Turks.

Nitre is successfully given in calentures, and pestilential fevers; to suppress and cool their destructive heats.

It is very manifest from gunpowder, that nitre has a great aversion to flame; whence proceeds that surprising ventosity and explosion.

Nitre is found to be, as it were the spirit of the earth: for it is certain that any clean earth, unmixed with nitrious bodies thrown on heaps, and kept covered and screened from the sun, so as to afford no vegetables, will copiously collect nitre: whence it is manifest, that the native spirit of nitre is of a lower rank than the spirit of animals, or even of vegetables.

Animals that drink nitrious water grow manifestly fat; which is a sign of coldness in nitre.*

Land is best improved by nitrious bodies; and all manure is nitrious; which shews there is a spirit in nitre.

From all which it is plain, that the human spirits may be cooled and condensed by the native spirit of nitre; and at the same time rendered more dense and less consuming: and therefore,

* Where are these nitrious waters found? or what is here properly meant by nitrious waters?

as strong wines, spices and the like inflame the spirits and shorten life; so nitre on the other hand, composes and condenses them, and conduces to longevity.

Nitre may be used at meals, mixed along with nine parts of table salt; it may also be taken with the breakfast or morning's-draught, from three grains to ten: but in what way soever it be moderately used, it is highly conducive to long life.

As opium stands first in virtue for condensing the spirits by flight, and has its less powerful but safer subalterns; which may be taken in larger doses, and with greater frequency; so nitre likewise, which stands first for condensing the spirits by cold, or rather by cooling and refreshing them at once, has its substitutes.

The substitutes for nitre, are those things which yield an odour somewhat earthy; as that of clean and good earth, newly broke or turned up with the plough or spade. Among the principal of these are borage, bugloss, langue de bœuf, burnet, strawberry the fruit and leaf, rasberries, raw cucumbers, raw apples, vine-leaves, vine-buds, and violets.

Next to these come such as have a certain greenness or rawness of smell, with some tendency to warmth, yet not without a cooling property: as balm, green lemons, green oranges, rose-wa-

ter; the pale, the damask, the red, and the musk-rose.

Let it be observed, that the substitutes for nitre, generally answer the intention better in a crude state, than after having felt the fire; because the cooling spirit is dissipated by heat: whence they are best taken, either infused in liquor, or without preparation.

As the spirits are somewhat condensed by the substitutes for opium, so likewise are they by the odour of the substitutes for nitre; so the smell of fresh and clean earth, received either by following the plough, or by digging or by weeding in the garden, excellently composes the spirits; which are likewise finely refreshed by the scent of the leaves that toward the end of autumn fall in the woods and hedges; but above all by the breath of a dying strawberry-bed; and the odour of violets, wall-flowers, bean-blossoms, sweet-briar, and honey-suckles, has a like effect whilst they are growing. And I knew a certain nobleman of a great age, who, as soon as he awaked in the morning, had a piece of fresh earth every day brought him, in order to receive its odour.

And no doubt but the blood being cooled and tempered by such cold plants as endive, succory, purslain, &c. might consequently cool the spirits; but this is a slow and indirect way; where-

as vapours operate immediately. And so much for the condensation of the spirits by cold.

3. The third kind of condensation is by appeasing the spirits. Now the spirits are appeased by such things as prove grateful and acceptable to them, without exciting or calling them out too much; but rather incline them to complacency and self-satisfaction, and to keep themselves within their own sphere. But the particulars of this enquiry are already satisfied by what is above delivered upon the substitutes for opium and nitre.

4. And for the fourth kind of condensation; viz. by quelling the too great vigour, and checking the impetuosity of the spirits, we shall speak to it below, when we come to enquire into their motions. So that having already spoke to their condensation, which regards the substance of them; we next proceed to their degree of heat.

It was before observed, that the heat of the spirits should be neither great nor consuming; but such as rather fits them to prey upon the hard resisting parts, than to carry off the light and fine ones.

Spices, wine, and spirituous liquors must be guarded against, and used with great moderation, and with intervals of abstinence. The same caution reaches to thyme, marjoram, pennyroyal, and all hot and inflammatory plants,

which impart not a recruiting, but a predatory heat to the spirits.

But a prudent and judicious use of these simples, sometimes by way of food, and sometimes by way of physick, will answer this intention, viz. elecampane, carduus benedictus, young cresses, germander, angelica, zedoary, vervain, valerian, myrrh, costmary, elder-flowers, and chervil.

It happens fortunately also, that the capital opiates are of excellent use in this operation; as by composition they afford such a heat as is wished for, but scarce found in simples; for by mixing together such hot things as euphorbium, pellitory, birthwort, opopanax, ammoniacum, galbanum, &c. to blunt the narcotic virtue of the opium, physicians make the medicines here required; as is excellently seen in the theriaca, and mithridate, which are not biting and pungent to the tongue, but only somewhat bitter, and of a strong scent, exerting their warmth in the stomach, and the subsequent passages.

A frequent excitation to venery, but rarely performing the act, conduces also to give the spirits a robust heat; and the like may be said of some other passions: of which hereafter. And so much for the heat of the spirits disposing to long life.

As to the quantity of spirits, with a view to

keep them down, and prevent their over proportion, it is but a short enquiry; since a small flame does not devour so much as a large one.

It seems confirmed by experience, that a slender and almost Pythagorean, monastic, or hermetic diet, regulated by penury and want, conduces to longevity. Such a regimen turns upon the drinking of water, lying hard, the use of a cold air, eating of herbs, fruits, dried flesh, and dried fish, wearing of hair-shirts next the skin, frequent fasting, frequent watching, few sensual pleasures, &c. all which diminish the spirits, and reduce them to a quantity barely sufficient to support the offices of life; whence they are rendered less predatory.

But if the regimen be not altogether so rigorous and mortifying, yet continually equable and uniform, it has the same effect; as a greater flame, when uniform and undisturbed, consumes less of its subject, than a small one agitated stronger and weaker by fits. And we have an eminent example of this in the regimen and diet of Cornaro the Venetian; who for many years continued to eat and drink by exact weight: thus preserving himself in full strength of body, and vigour of senses, to more than a hundred years.

Regard likewise must be had, that the body which is nourished to the full, and not emaciated

by the strict regimen above-mentioned, omit not the seasonable use of venery; lest the spirits should grow too turgid, and thus soften and relax the body. And so much for the moderate and frugal quantity of spirits.

Next follows the enquiry of checking the motions of the spirits; for motion manifestly tends to attenuate and over-heat them. They are checked three ways, viz. 1. by sleep; 2. by avoiding vehement labour, immoderate exercise, and lassitude; and 3. by bridling all troublesome passions. And first of sleep.

The fable goes of Epimenides, that he slept many years in his cave without eating; for the spirits waste and prey but little in sleep: and experience shews that dormice, bats, swallows, &c. shut up in close places, sleep the whole winter: the same is also supposed of bees and drones, though sometimes destitute of honey; and again of butter-flies, flies, &c.

Sleep in the afternoon is good for the spirits; as no unfriendly vapours then ascend to the head, and only the first light dew of the meal; though in all other respects with regard to health, it is pernicious and oppressive: but in extreme old age, both meals and sleep should be frequent, though short and small; and in the last stage of a long life, perpetual rest and repose are serviceable, especially in the winter. And as mo-

derstc sleep contributes to prolong life; it does it so much the more where it is pleasing, and not broken or disordered.

Quiet sleep is procured by violets, lettuce, especially boiled; saffron, balm, apples eat at going to bed; toast and malmsey, particularly if musk-roses are first infused in the wine. It were therefore proper to compose a pill, or some small draught of these ingredients; and to use it often. Those things likewise which close the mouth of the stomach, as prepared coriander-seed, quinces and roasted pears, cause pleasing sleep. But above all things in youth, especially if the stomach be strong, a good draught of cold water is proper at going to bed.

As to the business of trances, whether voluntary or procured, and of intent and deep thought, though without perturbation, we have nothing certain to offer; they may doubtless contribute to this intention, and condense the spirits more powerfully even than sleep; as they lull and suspend the senses as much or more than that: but of these particulars let farther enquiry be made. And so much for the affair of sleep.

We next proceed to motion and exercise. Lassitude is prejudicial: so is too sudden and violent motion and exercise; as running, tennis, fencing, and the like; so again is all endeavouring beyond the strength, as in leaping, wrestling,

&c. It is certain that when the spirits are strained, either by velocity of motion, or by extreme efforts, they afterwards become more predatory and consuming. On the other hand, the exercises that require a moderately robust motion, but not too quick, or beyond the utmost strength; as dancing, shooting with the long bow, riding, bowling, &c. are rather beneficial than hurtful.

We now come to consider the affections and passions of the mind, to see which of them conduce to, and which of them prevent long life. And first, extreme joy attenuates and dissipates the spirits, and shortens life; but familiar chearfulness corroborates the spirits without resolving them.

Sensual impressions of delight are bad; but the thoughts of joys passing in the memory, or the apprehension of them in hope, and expectation, are good.

A suppression, or gradual communication of joy, recreates the spirits more than profuse and sudden joy divulged all at once.

Grief and sadness, if unattended with fear, and not too afflicting, prolong life; for they contract the spirits, and cause a kind of condensation.

Great fears shorten life: for though grief and sadness condense the spirits, yet they cause only a simple contraction; whilst in fear, by reason

of the solicitude after the remedy, and an intermixture of hope, there is a kind of tormenting flux and reflux made of the spirits.

Anger, when suppressed, is also a kind of torture, and causes the spirits to prey upon the juices of the body; but when it has vent and breaks out, it becomes of service; as those medicines do which procure a robust heat.

Envy is the worst of passions, and feeds upon the spirits, and these again upon the body; the more because it is a lasting passion; and as the expression goes of it, keeps no holidays.

Pity for the misfortunes of others, which seem not likely to fall upon ourselves, is good: but that, which by a kind of similitude may reflect upon the pitying person is bad; on account of the fear it excites.

Moderate shame hurts not, as it somewhat contracts and again disperses the spirits; insomuch that bashful persons are generally long lived: but shame arising from some great ignominy, and continuing long to afflict, contracts the spirits even to suffocation, and is destructive.

Love, if successful, and not deep, is a species of joy, and comes under the rules above laid down of that.

Hope, is of all the passions the most advantageous, and greatly contributes to prolong life; if it be not too often disappointed, but entertains

the imagination with a prospect of good: whence they, who fix and propose to themselves any end as the pursuit of their life, and constantly advance by degrees therein, are generally long lived; but coming at length to the top of their hopes, and having nothing further to expect, they commonly languish and die soon after; so that hope may seem a kind of leaf-joy, and like gold, extremely ductile.

Admiration and moderate contemplation have a great power to prolong life; for these detain the spirits upon pleasing subjects, without suffering them to tumultuate and act disorderly: whence all the contemplators of natural things, who had so many and such great objects of admiration; as Democritus, Plato, Parmenides, and Apollonius were long lived. So likewise were the rhetoricians, though they only tasted such subjects, and pursued the light of discourse rather than the darkness of things; as Gorgias, Protagoras, Isocrates, Seneca. And indeed as old men are generally prattling and talkative; so great talkers very often live to be old: for this is a sign of slender contemplation, which does not much affect or torture the spirits; but subtile, acute and severe enquiries cut life short; for these fatigue and wear out the spirits. And so much for the motion of the spirits from the passions of the mind; whereto we will add a few

general observations upon the spirits, that fall not under the preceding division.

Particular care must be had, that the spirits be not often dissolved; for rarefaction precedes dissolution: and the spirits once rarefied cannot easily recover themselves, and become dense again. The spirits are diffused by hard labour, vehement passions of the mind, profuse sweats, large evacuations, warm bathing, and the immoderate or unseasonable use of venery; again, by too great cares, anxious disquietudes and expectations; and lastly by malignant diseases, and severe pains and tortures of the body; all which are, as much as possible, to be avoided.

The spirits are refreshed by things whereto they are both accustomed and unaccustomed. It strangely conduces to preserve the vigour of the spirits, not to use customary things to satiety, nor new ones before a strong and vigorous appetite requires them; and therefore customs are to be broke off with judgment and diligence before aversion comes on; and the desire of change is to be restrained for a time, till become strong and vigorous. The course of life must likewise be so ordered, as to have many and various renovations; that the spirits may not grow sluggish by perpetually conversing with the same things. For although Seneca sharply said, the fool is always beginning to live; yet this folly,

and numerous others, are conducive to long life.

It must be observed, contrary to what is usually done, that when men perceive their spirits to enjoy a good, a sound and a pleasing state, which appears from a greater tranquillity and pleasure of mind, they are then to cherish and not to change them; but when they are in a restless and disorderly state, which also appears from melancholy, indolence, and other indispositions of the mind, they are sometimes to oppress and alter them. Now the spirits are preserved in the same state, by restraining the passions, moderating the diet, abstaining from venery, and by using moderate labour, and moderate rest. They are altered and oppressed by the contrary; viz. vehement passions, gluttony, immoderate venery, hard labour, intense thinking, and much business. But it is the practice of men, when they are chearful, and best pleased with themselves, then most to affect and pursue feasting, venery, labour, difficulties, and business. Whoever desires to prolong life, must act in a contrary manner; and endeavour to support and preserve the good condition of his spirits; and discharge and change them when ill disposed.

It is well observed by Ficinus, that old men, to refresh their spirits, should frequently recollect and ruminate upon the actions of their youth

and childhood: and certainly such kind of remembrance is, as it were, the peculiar recreation and delight of old men; whence it is pleasant for men to enjoy the company of those they were educated with; and to visit the places where they were brought up. And Vespasian gave so much into this humour, that when he was emperor, he could not prevail upon himself to quit his father's homely house; for fear of losing his accustomed objects, or some part of the memory of his youth.

But the most grateful thing to the spirits is, a continual progression for the better; and therefore youth and riper years should be so conducted as to leave new comforts for old age: the principal whereof is moderate rest; whence old men in posts of honour, offer violence to themselves, if they do not retire. Of this we have a remarkable example in Cassiodorus, who was of such authority among the gothic kings of Italy, as to be the soul of their affairs; but retiring to a monastery at near the age of eighty, he there continued to a hundred. But in this respect two cautions are required; the first is, that they wait not till the body is quite wore out and distempered; for in that case all change, though for the better in appearance, hastens death: the second, that they give not themselves up to perfect indolence, but have something gratefully to

amuse their thoughts and feed the mind: to which purpose letters are best suited; and next to these, building and planting.

Lastly, one and the same action, study, or labour, undertaken by choice, and with a willing mind, refreshes the spirits; but if against the inclination, it wastes and destroys them: it is therefore conducive to long life, either that a man so shape his course by art, as to have it free and according to his own wish; or else procure himself such a pliable temper, that whatever is imposed upon him by necessity, may rather lead than drag him.

We must not omit, with regard to the government of the passions, that particular care should be had of the mouth of the stomach; but principally to keep it from being too much relaxed; because this part has a greater influence over the passions, especially the daily ones, than either the heart or brain; excepting only such as proceed from powerful vapours, as in drunkenness and melancholy.

And thus much for the operation upon the spirits, with a view to continue them in a flourishing and youthful state: wherein we have used the greater diligence, because physicians and other writers scarce touch upon it: but chiefly because the operation upon the spirits, and making them young again, is the readiest and short-

est way to prolong life, on account of two abridgments; the one, that the spirits operate immediately upon the body; the other that vapours and the passions operate immediately upon the spirits: so that these things go directly, and in a strait line to the end; whilst others reach it by a curve.

II.

THE HISTORY OF THE OPERATION FOR EXCLUDING THE AIR FROM THE BODY.

THE exclusion of the air, has a double tendency to prolong life; first, as after the native spirit, it more than any other thing preys upon the juices, and hastens the dryness of the body; so that how much soever air may otherwise animate, and contribute to health; yet the shutting of it out, externally, conduces to longevity.

The second effect, which follows upon excluding the air, is much more deep and subtile; for the body being closed up, and not perspiring, detains the included spirit, and turns it into the harder parts of the body; which therefore are kept soft and tender by the spirit.

The manner of this action appears in the desiccation of inanimate bodies; and it is a certain axiom, that bodies are dried by the avolation of their spirit; but rendered soft and yielding by its

detention. It must likewise be allowed the property of all heat, to moisten and attenuate; and to contract and dry only by accident.

To live in caves and dens, where the air receives not the sun's rays, may conduce to longevity; as the air of itself, without being animated by heat, has no great force to prey upon the body. And if we go backwards, it will appear from many remains and ancient monuments, that the size and stature of certain men have been much larger; and that these men generally lived in caves: and there is some affinity between length of age, and largeness of limbs. We also suspect the life of the Stylites, or anchorites of the pillar, bore some resemblance to a life led in caves; their bodies being secured, or screened from the sun's heat; and the air they breathed not being subject to great changes or inequalities. Thus much is certain, that both the Symeons, and Daniel, and Saba, as well as other Stylites, were very long lived. And even the modern anchorites, who were either immured, or shut up in pillars, have frequently lived long.

Next to the living in caves, is living upon mountains: for as the sun's heat penetrates not into caves, it has but little effect on the tops of mountains, for want of reflection. But this must be understood of mountains where the air is clear and pure, or where, by reason of the dry-

ness of the valleys, no clouds or vapours ascend; as in the mountains round Barbary, where to this day, men often live to a hundred and fifty years.

But though the air of these caves or mountains is not of its own nature considerably predatory; yet, as the air we live in is rendered so by the sun's heat, the body ought, as much as possible, to be secured against it.

The air may be excluded two ways; first by contracting the pores, and again by filling them up.

For contracting or shutting up the pores, the coldness of the air itself is serviceable; so are uncovering of the skin, which hardens it; bathing in cold water; and astringents used externally, such as mastich, myrrh, myrtle, &c.

But this intention is much better answered by baths (though to be seldom used, especially during the summer) consisting of such astringent mineral waters, as may be safely drank; for example, those of chalybeate and vitriolic springs; which powerfully contract the skin.

As for filling up the pores; paints and the like thick unctuous bodies, or, what may be used with more convenience, oil and fats preserve the substance of the body, as much as oil-paint and varnish preserve wood.

The ancient Britons painted themselves with woad, and were very long-lived; so likewise did

the Picts; who are from thence thought by some to have derived their name, which signifies painted men.

The inhabitants of Brasil and Virginia paint themselves to this day, and are very long lived, especially the Brasilians; insomuch, that five years since, the French Jesuits met with some of them who remembered the building of Fernamburg; a hundred and twenty years backwards; and yet were men grown at the building thereof.

Johannes de Temporibus, who is reported to have lived three hundred years, being asked by what means he preserved himself, is said to have answered, by honey within, and oil without.

The Irish, especially the Wild-Irish, are to this day very long lived; and they report, a few years ago, that the countess of Desmond lived to a hundred and forty, and shed her teeth three times: and it is a practice with the Irish, to anoint themselves with old salt-butter before the fire.

The Irish also were accustomed to wear their shirts and linen stained with saffron; which practice, though first introduced to prevent putrefaction, yet we judge it of the same service in prolonging life: for saffron, of all the things we know, is the best for cherishing the skin, and the flesh; as it has a remarkable astringency,

oiliness, and a subtile heat, without acrimony. And I knew an Englishman, who carried a bag of saffron about his stomach in a voyage, to conceal it and prevent paying the duty; and though at other times he used to be exceedingly sea-sick, he now continued perfectly well without the least retching.

Hippocrates advises to wear clean linen next the skin in the winter, but foul and besmeared with oil in the summer; the reason whereof seems to be this, that the spirits greatly exhale in the summer; and therefore the pores of the skin are then to be filled up.

We therefore judge that anointing the skin with oil, either that of olives or sweet almonds, greatly conduces to long life. And this should be done every morning upon rising; and with oil wherein a little bay-salt and saffron is mixed; but it ought to be laid on light, with wool, or a soft sponge, not so as to run, but barely to bedew and moisten the skin.

It is certain that liquors, even such as are oily, used in a large quantity, draw somewhat from the body: but on the contrary are imbibed by it in a small one: and therefore, as we said, the unction must be but slight and superficial; or else let only the shirt itself be a little rubbed with the oil.

It may here be objected, that this anointing

with oil, though not used among ourselves, has however been experienced, and left off by the Italians; and was anciently familiar, and a part of regimen among the Greeks and Romans; yet mankind in those ages were no longer lived than at present. To which it may be justly answered, that they used their oil only after warm bathing; unless we except their gladiators and wrestlers; but warm bathing is as contrary to this intention of ours, as anointing is congruous; the former opening, but the latter blocking up the pores: and therefore warm bathing without subsequent anointing is extremely bad for our purpose; but anointing without bathing excellent. Their anointing also was used in the way of delicacy, or at best to preserve health; but in no respect to procure long life: whence they employed at the same time precious unguents, which though grateful and pleasing in themselves, are prejudicial in our intention by reason of the heat. Whence Virgil seems to have well observed, that the use of oil was corrupted with spices.*

Anointing with oil contributes to health in the winter, by the excluding cold; and in summer by keeping in the spirits, and preventing their dissolution; as also by fencing against the force of the air, which is then most predatory.

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† Nec Casia liquidi corrumpitur usus olivi.

As anointing with oil is one of the most powerful remedies for prolonging of life, we shall here add a few cautions about its use, to prevent endangering the health: and these cautions are principally four, with regard to the four inconveniencies that may follow upon it.

The first inconvenience is, that by suppressing the sweat, it may produce distempers from excrementitious humours; but this may be remedied by the use of purges and glysters, so as to procure a proper discharge; for it is certain, that evacuation by sweat has a general tendency to health, but shortens life; whilst moderate purgatives operate upon the humours, and not, as sweat does, upon the spirits.

The second inconvenience is, that our anointing may sometimes heat and inflame the body; because the spirits when shut up, and not suffered to perspire grow warm: but this is prevented by a cooling diet, and the use of some proper refrigerants at due intervals; of which more in our next enquiry into the operation upon the blood.

The third inconvenience is, that it may oppress the head; as all external obstruction strikes back the vapours, and turns them upon that part: but this is entirely prevented by catharticks; especially by glysters, and strongly closing the mouth of the stomach with astringents: again also by combing and rubbing the head, along

with the use of proper perspirative lixiviums; not omiting suitable exercise, that some perspiration by the skin may likewise be procured.

The fourth inconvenience is more subtile; viz. that the spirits detained by closing up the pores may seem to multiply too fast; because, as little exhales, and new spirit is constantly produced, the quantity may increase too much; and so that body come to be preyed upon; but this is not entirely the case; for all spirit shut up and not fanned, becomes languid, like flame unanimated by air; whence it becomes less active, and less productive of new: but doubtless its heat is thus increased, though its motion be retarded; which is likewise the case of flame. But this danger may be prevented, by sometimes mixing refrigerant ingredients along with the oil, such as roses, and myrtle; for no hot things are here to be used.

It may be likewise serviceable to wear such garments as are somewhat unctuous or oily, and not aqueous; because these exhaust the body less: such as those of callico rather than linen; and it is manifest that the spirits of odorous bodies hang much longer in woollen than linen; and therefore though linen is more elegant and grateful to the touch, yet we suspect it for this intention.

It is a practice among the wild Irish, when

first taken sick, immediately to unsheet their bed, and roll themselves in the blankets. And some declare themselves to have with great advantage to their health, wore flannel waistcoats and drawers next their skins.

It must also be observed that the air, whereto the body is accustomed, consumes less than new, or a frequent change of air; whence poor people that never remove from their own roof, are generally long lived: in other respects, we judge a change of air to be useful, especially to those of brisk spirits; but a moderation herein may prove best on all accounts. The way would be to change the place of abode, and at stated times remove to proper seats, suited to the four seasons of the year; whereby the body might have neither too much fatigue in travelling, nor too much rest at home. And this for the operation of excluding the air, to avoid its predatory or consuming force.

III.

THE HISTORY OF THE OPERATION UPON THE BLOOD, AND THE PROPER HEAT FOR SANGUIFICATION.

THE present and the following operation are the converse of the two foregoing; and answer to them as passives to actives: for as those prevent the spirits and air from being too preda-

tory in their actions; so these secure the blood and juices of the body, and keep them indisposed to be preyed upon. But as the blood is the fountain that supplies the juices, waters the parts, and is the matter prepared for composing them, we assign the first place to the operation upon the blood; with regard whereto we shall lay down three very effectual directions.

And first, no doubt if the blood be brought to a cooler temper, it will become less dissipable; but as refrigerants taken by the mouth, ill comport with many other intentions, it is most advisable to find out others, not subject to such inconveniencies: and there are two of them.

The one is, the use of glysters, in no respect purging or abstersive, but only cooling and somewhat opening; to be injected principally in youth: and those are best approved which consist of the juice of lettuce, purslane, liverwort, the greater houseleek, and the mucilage of fleawort-seed; with the addition of some moderately aperient decoction, and the admixture of a little camphire: but in declining age, let the houseleek and the purslane be omitted; and the juices of borage, endive or the like be substituted for them. These glysters should be retained as long as possible, or for an hour or more.

The second is to use, especially in the summer, baths of sweet and scarce lukewarm water,

without any emollient ingredients; such as mallows, the herb mercury, milk, &c. but rather a moderate proportion of new whey and roses.

But what we take for the capital thing of all in this intention, though never mentioned till now, is, before bathing to anoint the body with oil, properly thickened like a paint; that the coolness of the water may be received, yet the water itself kept off; though without closing the pores of the body too much: for where external cold shuts up the body strongly, it is so far from procuring coolness, as rather to prevent it, and excite heat.

What bears some analogy to this, is, the use of bladders filled with refrigerating decoctions and juices, and applied to the lower region of the body, viz. the whole abdomen; thus making a kind of bath, where the substance of the liquor is excluded, and its coldness principally, or alone received.

The third direction regards not the quality, but the substance of the blood; with design to render it less dissipable, closer of texture, and of such a disposition, that the heat of the spirit may the less affect it.

And for the use of gold, either in leaf or filings; the powder of pearls, coral, gems, and the like, we have no farther opinion thereof, than as they may possibly answer the present intention: and

surely since not only the Arabians, but also the Greeks and the moderns have ascribed such great virtues to these medicines, there may seem to be somewhat in them, which so many persons declare they have experienced. To drop, therefore, all fanciful notions about them, we judge, that if there could be some such thing conveyed into the whole mass of blood, and intimately mixed therewith in the smallest particles, whilst the spirits and heat might have little or no effect upon this matter; it would prevent, not only putrefaction, but dryness, and prove exceedingly efficacious in prolonging life. But this affair requires several cautions; as 1. That the substance be ground exceedingly fine; 2. That it be free from all malignity, lest coming into the veins, it should do mischief; 3. That it be never taken at meals, nor so as to lodge long by the way, for fear of producing dangerous obstructions about the mesentery; and 4. That it be used but seldom, to prevent its clodding in the veins. And therefore let it be taken in the morning fasting, in a glass of white wine, mixed with a little oil of almonds; and using some proper bodily exercise upon it.

The simples best conducive to this operation may be reduced to three, viz. gold, pearl, and coral; for all the other metals, except gold, have some malignant quality in their volatile part;

nor can they be so exquisitely ground as leaf-gold. And for all the transparent gems, they are but a kind of glass; and therefore to be rejected for fear of wounding and tearing the finer vessels.

But, in our judgment it would be safer, and more effectual to use woods by way of infusion or decoction; as these may be sufficiently able to give strength and durability to the blood, without the danger of causing obstructions; especially as they may be taken along with the diet, and thence be the easier received into the veins, and not thrown off with the fæces.

The woods proper for this purpose are saunders, oak, and the vine; for we reject the hotter kinds, and such as are any way resinous. We might also add the dry and woody stalks of rosemary; this being a shrub as durable as many trees; and again the dry and woody stalks of ivy; to be used in such proportion as not to prove ungrateful to the taste.

Let these woods be taken either boiled in broths, or steeped in new wine or beer, before the liquor grows fine. When used in broths, let them be long infused before boiling, that the firmer part of the wood, and not only that which sticks but loosely in it, may be drawn out. And so much for the operation upon the blood.

IV.

THE HISTORY OF THE OPERATION UPON THE JUICES OF THE BODY.

We before observed, in our enquiry into inanimate bodies, that there are two kinds of substances which consume with difficulty; viz. hard and fat ones; as appears in metals and stones; oil and wax.

The intention therefore must be to render the juices of the body hardish and unctuous.

Hardness is procurable to them three ways, viz. 1. By aliment of a firm nature. 2. By cold, condensing the skin and flesh; and 3. By exercise, binding up and working the juices together, or preventing them from growing soft and frothy.

The aliment should be of the most substantial or undissipable kind; as beef, pork, venison, goat, kid, swan, goose, and ring-dove; especially when moderately salted: again, salt and dried fish, old cheese, &c.

As to bread; that of oats, or with a little mixture of pease, and that of rye or barley is more solid than that of wheat; and of wheat bread, that is the more solid which has somewhat more of the bran.

The inhabitants of the Orcades, who feed upon salt fish, and generally all fish-eaters, are long lived.

The monks and hermits, who used a sparing and dry diet, were also generally long lived.

A free use of clear water for drink renders the juices of the body less spumy; and because of the dulness of its spirit, which doubtless in water is not very penetrating, we judge it of use to dissolve a little nitre therein. And so much for the firmness of the aliment.

2. As for condensing the skin and flesh by cold; we find such persons are generally longer lived, who live in the open air, than those that live under cover; and the inhabitants of cold countries longer lived than those of hot ones.

Too much covering upon the bed, and too much clothing soften and dissolve the body.

Cold bathing is serviceable to prolong life; but warm bathing is prejudicial: and for bathing in astringent mineral springs, we have spoke of it above.

3. With regard to exercise; an unactive life manifestly renders the flesh soft and dissipable; but robust exercise, if without too much sweat and lassitude, hard and compact. Exercise also in cold water, as that of swimming is very advantageous; and in general, exercise in the open air, is better than under cover.

As for frictions, though these are a species of exercise, yet as they rather call forth than indurate the aliment, we shall not speak to them here, but hereafter.

We come next to the unctuousness or roscidity of the juices; which is a more perfect and powerful intention than induration; as having no inconvenience or mischievous effect: for all those things which tend to harden the juices, at the same time that they prevent the wasting of the aliment, also prevent its repair; and thence are both conducive to, and preventive of long life; whilst that which regards the roscidity of the juices, proves advantageous in all respects; as rendering at once the aliment less dissipable, and more reparable.

By saying that the juices should be roscid or unctuous, we mean not this of any manifest fat; but only that a dewy, balmy, or, to use the vulgar expression, a radical moisture, should be every way diffused through the habit or substance of the body.

Nor again, let any one imagine that oil, or fat meats, or marrow, beget these juices, and so answer the present intention; for whatever is once perfected, never goes its course over again: but the aliment ought to be such as, after digestion and maturation, at length produces a balminess in the juices.

Nor must it be imagined, that though simple oil or fat collected together, be of itself hard to dissipate; yet it assumes another nature in mixture: for as oil alone, wastes much slower than water alone, so does it also hang longer in paper or cloth, and dries slower; as was observed above.

For spreading these roscid juices through the body, roasted or baked meats are better disposed than boiled; and all preparations of meat with water are less proper: thus we see that oil is yielded more copiously by dry bodies than by moist ones.

In general, the free use of sweet things conduces to procure this roscidity of the juices; such as sugar, honey, sweet almonds, pine-apples, pistachios, dates, raisins, currans, figs, &c. As on the contrary, all acid, over saline, and too acrimonious things, are preventive thereof.

Nor let us be thought to favour the Manichees, and their diet, if we direct a frequent use of seeds, nuts, and roots, in meats or sauces; since all bread, which is the capital food, is either made of seeds or roots.

But above all, the quality of drinks is what most conduces to diffuse roscid juices through the body; as being the vehicle of the food: and h erefore let the drink turn upon such liquors as are subtile, but without acrimony or acidity;

viz. wines which have lost their pungency; or, as the old woman in Plautus expresses it, are grown toothless with age.* And the same is to be understood of malt liquors.

We conceive that mead would be a proper liquor, if made strong and kept till it was old; but since all honey has some acid or sharp parts, as appears from the corrosive water which chemists draw from it that even dissolves metals, it were better to make a like drink of sugar; not by a slight infusion, but by a thorough incorporation; in the same manner as honey is incorporated in mead: and this should be kept for a year, or six months, before it is used; whereby the water employed in the composition, may both lose its crudity, and the sugar acquire a subtilty of parts.†

Age, in fermented liquors, has the property of procuring subtilty in all the parts, and acrimony in the spirit; the former of which is beneficial, but the latter prejudicial: therefore, to remedy this undue mixture, let a proper portion of well boiled venison, or pork, be put into the cask, before the liquor is fallen fine, or whilst it continues new; that the spirit of the liquor may have

* Vina vetustate edentula

† See the article *Sugar*, in the Sylva Sylvarum.

somewhat to feed and prey upon; and thence deposite its acrimony.*

In like manner, a drink brewed, not entirely of grain; as malted barley, wheat, oats, pease &c. but with the addition of about a third part of roots, or fat pulps; as potatoes, artichoak-bottoms, burdock-roots, &c. we conceive would be more conducive to long life, than a drink prepared entirely of grain.

Again, such things as abound with very fine parts, yet without all acrimony or pungency, may be employed in the way of sauce, pickle, or sallad: and this kind of property we find in some few flowers; as those of ivy; which being pickled in vinegar, are pleasant to the taste; those of marigold, and those of betony. And so much for the operation upon the juices of the body.

V.

THE HISTORY OF THE OPERATION OF THE VISCERA; FOR PROTRUDING THE ALIMENT.

THE writings, prescriptions, and directions of physicians, may shew what things assist the four principal viscera; (viz. the stomach, the liver, the heart, the brain; which are the seats of con-

* See the articles *Clarification, Drinks,* &c. in the Sylva Sylvarum

coction) in the due performing of their functions; whereby the aliment is distributed into all the parts, the spirits sent out, and thence the repair of the whole body secured.

We here speak not of the spleen, the gall, the kidneys, the mesentery, the intestines, and the lungs; because these are parts subservient to the principal ones: though in a discourse of health and diseases, they might sometimes be of capital considerations; as each of them has its particular distempers, which, unless cured, affect also the principal viscera. But with regard to the prolongation of life, the repair by alimentation, and retarding the waste brought on by old age; if the concoctions and these principal viscera are well secured, the rest, in great measure, proceeds successfully.

Every one must, for himself, collect such particulars from the writings of the physicians that treat of comforting and preserving the four principal viscera, as the nature and constitution of his body requires; and apply them in his diet and regimen of life: for the preservation of health generally requires only temporary remedies; but the prolongation of life is to be endeavoured by a thorough regimen, and a constant course of assisting remedies: a few of the best whereof, selected with choice, we shall here propose.

The stomach, which provides for all the other parts, and whose strength is fundamental to all the other concoctions, should be so defended and secured as to remain moderately warm, constringed, clear, and unoppressed by nauseating humours; yet never entirely empty; as being rather nourished by itself than by the veins: and lastly, in good appetite; because appetite promotes digestion.

It seems strange, that the practice of drinking liquors hot, which prevailed among the antients, should be grown into disuse. I remember a very eminent physician that used, at dinner and supper, greedily to swallow down his broth very hot; and presently after to wish it up again, saying, He did not want the broth; but only the heat. And indeed I conceive it useful, to take the first glass of liquor, whatever it be, always hot at supper.

We likewise judge such wine proper at meals, wherein gold has been quenched; not as believing the gold communicates any virtue to the wine; but, as knowing that all metals quenched in any liquor, give it a powerful astringency: and we make choice of gold, because it leaves no other metallic impression, besides the desired astringency, behind.

Towards the middle of the meal, we judge, that bread dipped in wine, is better than wine it-

self; especially if the wine it is dipped in be first impregnated with rosemary and citron-peel; and also sugared, to make it pass the slower.

The use of quinces is, by experience, found to strengthen the stomach; but, in our judgment, the clarified juice made into a marmalade, or syrup, with sugar, is preferable to the flesh, or pulp; as it thus proves less oppressive to the stomach: and the marmalade eat by itself, after meals, or along with vinegar before them, is excellent.

The simples best suited to the stomach are rosemary, elecampane, wormwood, sage, and mint.

We approve of pills composed of aloes, mastich, and saffron, taken before dinner, especially in the winter; provided the aloes be not only several times washed in the juice of roses, but also in vinegar, wherein gum traganth is dissolved; and afterwards steeped, for some hours, in fresh drawn oil of sweet almonds, before it is made up into the mass.*

Wormwood-ale, or wine, with a small addition of elecampane and yellow saunders, is properly used at intervals; though best in the winter.

But in the summer, a glass of white wine diluted with strawberry-water; the wine having

* See the article *Medicine*, in the Sylva Sylvarum.

first stood upon fine powder of pearls, craw-fish-shells, and (though this may seem strange) a little chalk; admirably strengthens and refreshes the stomach.

But in general, all morning-draughts of cooling liquors, whether juices, decoctions, whey, &c. are to be avoided; and nothing that is purely cold taken upon an empty stomach. Such things are better used, if occasion be, five hours after dinner; or an hour after a light breakfast.

Often fasting is prejudicial to long life; and all thirst must be avoided: the stomach being kept sufficiently clean, but continually moist.

A little mithridate being dissolved in fresh oil-olive, and rubbed upon the spine, opposite to the mouth of the stomach, strangely cherishes and refreshes the stomach.

A little bag filled, with fine teased wool, or scarlet flax, and steeped in rough red wine, impregnated with myrtle, citron-peel, and a little saffron, may be constantly wore upon the stomach. But enough of remedies for comforting the stomach; since many of those which answer the other intentions, also conspire to answer this.

As to the liver; if it be preserved from dryness and obstruction, it requires nothing more; for that relaxation of it which produces aquosities, is plainly a disease: but the coming on of

old age, also causes the other two. And this intention is chiefly answered by the remedies above set down, under the operation upon the blood: but we will here add a few more to them, selected with choice.

Let a principal use be made of the wine of sweet pomegranates, or, if that cannot be procured, of their juice fresh expressed: to be taken in the morning with a little sugar, a bit of fresh citron-peel, and three or four whole cloves, put into the glass wherein the juice is squeezed. And let this be continued from February to the end of April.

Before all other herbs, let young cresses be used; either in the way of sallad, in broths, or in drinks; and next to this scurvy-grass.

Aloes, in what manner so ever washed, or corrected, is prejudicial to the liver; and therefore never to be used common: but rhubarb is sovereign to the liver, if used with three cautions; viz. 1. if taken a little before meals; to prevent its drying too much, or leaving a styptricity behind: 2. if it be steeped for an hour or two in fresh oil of almonds, along with rose-water, before it be otherwise infused, or given in substance: and, 3. if taken alternately, one while simple, another while with tartar, or a little bay-salt; to prevent its carrying off only the

finer parts, and leaving the mass of humours more stubborn than before.

We judge it proper to take a dose of chalybeate wine, or decoction, three or four times a year; to dissolve the more stubborn obstructions; provided it be each time preceded by two or three spoonfuls of new drawn oil of sweet almonds, and followed by due motion of the body; especially of the arms and belly.

Sweet liquors, made with a mixture of some fat substance, have a great and capital efficacy to prevent dryness, parchedness, and saltness of the liver; and preserve it in a youthful state; especially if they are well incorporated by age. Thus, in particular, wines and drinks made of new raisins, jujebs, figs, dates, parsnips, pistachios, the bulbous roots, as potatoes, &c. sometimes with a mixture of liquorish; and again, drinks made with maiz, or Indian corn, are of great service. And the intention of preserving the liver in a certain soft and balmy state, is of much greater efficacy than that which regards the opening of it; which rather tends to health than the prolongation of life: only such obstructions as cause parchedness of the liver, are as destructive as other kinds of dryness.

The roots of succory, spinage, and beet, separated from their pith, and boiled tender in water,

with a third part of white wine, are serviceably eat along with oil and vinegar, in the way of sauce at meals; so likewise are asparagus, artichoak-bottoms, and burdock-roots, properly boiled, and served up in the same manner: and again, in the spring-time, pottage made with vine-buds, and the green blades of wheat. And so much for preserving the liver.

The heart receives the greatest relief and prejudice, 1. from the air we breath; 2. from odours and vapours; and, 3. from the passions of the mind. And, in this respect, many of the particulars above noted of the spirits, may be applied here. But as for the indigested heap of cordials, to be found among the writers on medicine, they are of little service in this intention; only such as have an antidotal virtue may be used, with judgment and discretion, for strengthening the powers of the heart; especially such as do not so much oppose the peculiar nature of poisons, as fortify and preserve the heart and spirits against them. And for particular cordials, the table of them, above drawn up, may be consulted.*

A wholesome air for habitation, is better discovered by experience than by signs: but we judge that of open plains, or champaign coun-

* See Sect. VII.

tries, to be the best; where the soil is dry, not parched or sandy, but spontaneously grows wild thyme, and wild marjoram; with up and down some tufts or sprinklings of calamint; and which is not otherwise bare, but interspersed with trees for shade; and where also the dog-rose smells somewhat aromatic. As for rivers, we conceive them rather prejudicial; unless very small, clear, and gravelly bottomed.

It is certain that the morning air is more vital and refreshing than that of the evening; though the latter be coveted more through delicacy. And we judge the air agitated with breezes, to be more healthy than that which is serene and still. The western breezes seem wholesomest in the morning, but in the afternoon the northern.

Odours are very effectual in reviving the heart. But a good odour is no property of a good air; for some airs are found to be perfectly pestilential, though of a less disagreeable scent than others more innocent; in like manner, conversely, there are wholesome airs, and very agreeable to the spirits, yet either absolutely inodorous, or less fragrant and grateful to the sense. And those who live in a good air, should only make use of odours at certain intervals; because a continued odour, though ever so excellent, proves somewhat oppressive to the spirits.

And for this purpose we recommend, before all others, the odours of plants and vegetables, uncropt and growing, to be received in the open air; as from blooming violets, pinks, and july-flowers, bean-flowers, lime-tree-blossoms, honey-suckles, yellow wall-flower, musk-roses, which yield their smell more copiously on the bush than other roses; dying strawberry-beds, sweet-briar, calamint, lavender in flower: and, in hot countries, oranges, citrons, myrtle, and bays. And therefore to walk, or sit sometimes in the atmospheres of these vegetables, will be of use.

For recreating the heart, we prefer cooling odours to such as are heating; and therefore recommend as excellent, and to be used in the morning, or during the noonday-heat, a certain perfume or vapour, made by throwing a mixture of equal parts of vinegar, rose-water, and good wine, upon a hot iron plate. And the same intention might be answered by pouring fragrant wine into a hole made in good fresh earth, and stirring the moistened mould about with a spade. It is likewise excellent, now and then, to smell at, or snuff up the nostrils, orange-flower-water, mixed with a moderate proportion of rose-water, and fragrant wine.

Masticatories held almost continually in the mouth, composed of such things as cherish the

spirits, are exceeding useful. And to supply the want of the famous Indian betel, little troches may be made of orrice-root, lignum aloes, lignum rhodium, roses, musk, and ambergris; the mass being beat up with rose-water, and a little Indian balsam.

The vapours arising from things taken internally, for strengthening and fortifying the heart, should be benign, clear, and cooling; for heat in vapours is bad: and wine itself, though thought to have only a heating vapour, is not without some opiate virtue. By clear vapours we understand, such as have more of real or aqueous vapour than of fume or exhalation; without at all participating of smokiness, sootiness, or greasiness; but being purely moist and uniform.

From an unwieldy heap of cordials we may select a few, fit to be made a part of diet: and what may supply the place of all the rest, are, for the purpose of warming; ambergris, saffron, and kermes-berries; and for cooling, the roots of bugloss, and borage, as also citrons, lemons, and apples.

We have, above, spoke of gold and pearls, which taken in the manner there prescribed, may, besides their action in the finer vessels, have also some effect upon the viscera in their passage; and cool without any noxious quality.

But for bezoar, though by reason of the numerous instances of its virtues, we cannot wholly reject it; yet doubtless its preparations should be such as may make it easily impart its virtue to the spirits: so that we cannot approve of taking it in broths, syrups, simple-waters, or the like; but rather in wine, cinnamon-water, or the like spirituous and distilled liquors, though not made hot and strong.

We have already spoke to the passions of the mind, and have only here to add, that all great, lasting, noble, or heroical desires, strengthen and enlarge the powers of the heart.

With regard to the brain, the seat and office of the animal spirits, what we have above delivered of opium of nitre, and their substitutes, and again, of procuring quiet sleep, have some right to this place also. And as it is certain that the brain is under the influence of the stomach; what is before said of defending and preserving the stomach, may likewise be understood of the brain by consent. We shall, however, propose a few remedies for the brain in its own particular; three of them external, and one internal.

And first, we recommend the practice of bathing the feet, at least once a week; the bath being prepared of a decoction of sage, camomile, fennel, sweet marjoram, costmary, the green leaves of angelica, and bay-salt.

We likewise recommend a suffumigation, or fume, to be used every morning; the ingredients thereof being dried rosemary, dried bay-twigs, and lignum aloes; omitting the sweet gums which oppress the head.

Great care must be taken of applying hot things externally to the head; as spices, or even nutmeg itself: such hot things are only fit for the soles of the feet, and should be no where else applied. Yet we recommend a gentle anointing of the head with oil, made by the infusion of roses and myrtle; with the addition of a little salt and saffron.

Considering what is above delivered of opiates, nitre, and the like, which greatly condense the spirits; we judge it proper once in a fortnight, to take three or four grains of castor, with a little angelica seed, and calamus aromaticus, in the morning; for these ingredients strengthen the brain, and excite a vivacity and vigour in that density of spirits, which is so necessary to long life.

In these methods of supporting the four principal viscera, we have offered such things as are well adapted, culled out by a deliberate choice, and capable of being brought into diet and regimen, with safety and convenience: for multiplicity of medicines is the child of ignorance. Nor is it so certain, that many dishes cause many

diseases; as that many medicines perform few cures. And so much for operating upon the principal viscera, with regard to protruding the aliment.

VI.

THE HISTORY OF THE OPERATION UPON THE EXTERNAL PARTS; FOR ATTRACTING THE ALIMENT.

ALTHOUGH it be the capital thing towards a perfect alimentation of the body, to have concoction well performed in the internal parts; yet the external also must contribute their action; that as the inward faculty propels and sends out the nutriment; so the faculty of the outward parts may attract and lay hold of it: and the weaker the digestive faculty proves, the more occasion it has for the concurring assistance of the attractive one.

A powerful attraction of the external parts, is principally caused by the motion of the body; whereby the parts being heated and cherished, eagerly invite, and attract the aliment to them.

But great care must be had, that the same motion and heat which calls forth the new juices to the parts, do not at the same time too much rob those parts of the juices they were before supplied with.

Frictions highly conduce to answer this intention, being used particularly in the morning; but this operation should always be immediately succeeded by a slight motion of the body; lest otherwise the attrition should exhaust and dry up the external parts, by making them perspire too much.

What approaches nearest to this is exercise, by which the parts mutually rub and chafe each other; but it ought to be moderate, not too quick, nor above the strength, or productive of lassitude. And here, as well as in the case of frictions, care must be had that the body perspire not too much: and therefore exercise is better in the open air than under cover; and better in winter than in summer. But exercise should not only, as well as frictions, be succeeded, but also, when vehement, preceded by unction; in the manner of the ancient wrestlers.

That exercise may not too much consume the spirits, or dissolve the juices, it is best to be used upon a stomach not quite empty: and therefore, that it may not be practised upon a full stomach, which is very prejudicial to health; nor fasting, which is very prejudicial to long life; a proper kind of breakfast should be used, consisting both of meat and drink; though in a very moderate and sparing quantity.

Exercises for distributing the juices through the body, should affect all the limbs equally; and not so as to move the legs, and rest the arms, but so as that every part may have its share of motion: and it greatly conduces to long life, that the body be never long kept in the same posture; but to change it at least every half hour, except in sleep.

The things commonly used by way of mortification may be employed to prolong life; for hair-shirts, scourging, and all severities used to the external parts, increase their attractive power.

Cardan recommends the external application of stinging-nettles, even in the case of melancholy; but we have little certain knowledge of their efficacy: and suspect the practice of giving some venomous quality; as the nettles by frequent use, may breed exulcerations and tettery humours in the skin.

VII.

THE HISTORY OF OPERATION UPON THE FOOD; SO AS TO MAKE IT INSINUATE INTO THE PARTS OF THE BODY.

The vulgar censure of luxury, or variety in diet, becomes the mouth of a reformer better than of a physician: an uniform, sparing tabl-

may indeed somewhat prevent interruptions in health; but at the same time it is prejudicial to long life, because a various and different mixture of aliment is better and quicker admitted and received into the blood and juices, than such as is simple and homogeneous. It has also a very great power to excite the appetite; which is the spur of digestion. We therefore approve of a well furnished table; and a frequent change of dishes, according to the season of the year, or otherwise.*

So likewise, that notion of a simplicity of meats, without sauce, is but flashy and idle; for well chosen sauces are the wholesomest preparations of food, and contribute both to health and long life.†

Care must be had to accompany meats hard of digestion, with stronger liquors; and sauces that penetrate and attenuate; but such as digest easily, with thinner drinks and richer sauce.

To the direction lately given, for taking the first glass of liquor warm at supper; we here

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* Let due care be here taken to understand the author justly; and the grounds and reasons whereon he founds this judgment.

† Many physicians seem to have introduced a kind of monastic diet into medicine. Let the enquiry be duly prosecuted on both sides, before judgment is passed.

add, that by way of preparing the stomach, a good spiced glass of the liquor any one is most accustomed to, should be taken warm, half an hour before meals.

A well regulated preparation, and dressing of bread, meats, and drinks, directed with a view to the present intention, is a thing of exceeding great moment; though it appear mechanical, or to smell of the kitchen and the cellar; and infinitely more useful than all the pompous, fabled virtues of gold, gems, and bezoar.

To think of moistening the juices of the body by a moist preparation of food is childish; this may somewhat allay the heats of distempers, but is directly opposite to the nature of a balmy nutriment; and therefore, for the present intention, the boiling of meats is by no means comparable to roasting, baking, and the like.

Roasting should ever be performed quick, and with a brisk fire; for meats are palled, and lose their nutrimental parts, by delay, and continuing at a slow fire.

All the more solid flesh-meats in use should not be dressed quite fresh; but a little salted; so as in great measure, or entirely, to prevent the use of salt at the table: for salt incorporated with the food, is of more service in distributing the nutriment than when used loose.

There remain to be brought into use, various proper methods of macerating and steeping flesh in convenient liquors, before it is dressed; like those sometimes practised in the pickling of certain fish, and the preparing of dishes for the oven.*

The beating, bruising, or stamping of flesh before it is dressed is of singular service. Every one acknowledges, that game taken by hawking, or by hunting, eats the finest; unless where the chase was too long continued: and certain fish become much better food by being whipt and beaten; as hard and austere fruits become soft by squeezing and pressure. But the best preparation of all would be, to bring into use a method of bruising and stamping the harder kinds of flesh before dressing.

Bread moderately leavened, and very little salted, is the best; and should be baked in a sufficiently hot and quick oven.

All that regards the preparation of drinks for long life, may be nearly included under a single precept. The use of water, as the only potable liquor, may preserve life for some time; but, as we formerly observed, can never carry it to any

* See the author's new Atlantis ad finem. And his Sylva Sylvarum, under the article *Foods*.

great length. This needs no preparation. But for spirituous fermented liquors, the capital and almost only caution they require is, that their parts be rendered exceeding subtile; and the spirit exceeding mild and gentle. Age alone can hardly procure this effect; for though it renders the parts somewhat more subtile, yet at the same time it renders the spirits more acrimonious: and therefore we, before, gave directions for steeping some fat substance in the cask; to take off this acrimony of the spirits. There is another way of procuring the same effect, without infusion or mixture; viz. by keeping the liquors in constant agitation; as, either by carrying them to sea, continuing them upon carriages at land; or suspending small vessels by ropes, and swinging them daily, &c. for it is certain that such local motion attenuates their parts; and works the spirits so much into them, that they cannot afterwards turn tart or biting.*

In extreme old age, the food should be so prepared as to become a kind of half chyle before it is used. But for distillations of meat, they are perfect trifles; as the nutrimental and best part of them, does not at all rise in vapour.

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* See the Sylva Sylvarum, under the articles, *Clarification, Maturition*, &c.

To incorporate meat and drink together, before it comes to the stomach, is advancing in a degree towards chyle; and therefore, for example, let chickens, partridges, pheasants, &c. be boiled in water with a little salt; then cleansed, made dry, and stamped; and afterwards put into new wine, or beer, whilst it is working, with the addition of a little sugar.

Expressions also, and fine choppings of meats, well seasoned, are proper for men grown very old; the rather, because they generally want teeth to chew their food; which is an extraordinary method of preparing it.

Three things may contribute to supply the defect of teeth: viz. 1. The productions of new ones; which seems extremely difficult, and not possible without an intimate and powerful renovation of the whole body. 2. By hardening the gums so, with the use of proper astringents, that they may in some measure perform the office of teeth; which seems not altogether impracticable. And 3. By preparing the food in such a manner as not to require chewing; which is a ready and easy method.

With regard to the quantity of meat and drink; some excess in both is now and then convenient, for washing or overflowing all the parts of the body; and therefore immoderate

eating and drinking, at certain times, should not be absolutely prohibited.

VIII.

AN EXPLANATION OF THE OPERATION UPON THE LAST ACT OF ASSIMILATING THE FOOD.

THERE needs no more than a short and simple direction about the last act of assimilation; which is the thing intended by the three operations immediately preceding: as this affair rather requires explanation, than any variety of rules.

It is certain, that all bodies have some appetite of assimilating, or turning into their own substance such things as are next them. This is done copiously and briskly by all subtile and pneumatical bodies; as flame, air, and spirits: and but very weakly by those of a gross, tangible substance, which have their appetite of assimilation bound down, and restrained by a stronger appetite of rest, and avoiding of motion.

It is likewise certain that this appetite of assimilation, which we observe to be kept under, and rendered unactive, in gross tangible substances, is still animated, or somewhat released, set free, excited, and at length actuated by heat, or spirit, coming in contact with them. And

this is the only reason why animate bodies do, and inanimate bodies do not assimilate.

Again, it is certain that the harder the consistence of a body is, the greater heat it requires to excite the act of assimilation; but in old age it happens, very disadvantageously, that all the parts grow stubborn, and the heat grows weak: and therefore this stubbornness of the parts must be either mollified, or the heat encreased. But of malaxing the parts we shall presently speak, in particular; and have already proposed many expedients for preventing their hardness. And for the other intention, of increasing heat, we shall lay down a single rule upon the strength of the following axiom.

The act of assimilation, being excited by the mediation of heat, is an extremely subtile and intimate motion, in the small particles of the matters concerned: but such motions are in greatest motion when the local motion ceases; which might otherwise disturb it. For the motion of separation into homogeneous parts; as in milk, where the cream rises, and the thinner parts subside; could never be effected if the milk were kept, though but in a gentle agitation: nor will water, or mixed bodies, putrify whilst they are continued in perpetual local motion.

As, therefore, the act of assimilation is prin-

cipally performed in sleep and rest; especially towards the morning, after the distribution has been made of the aliment; we can think of no other rule to answer this intention, than to sleep warm; and towards the morning use such a kind of motion, or put on such a prepared linen bed-gown, as may excite a moderate heat: and upon this to sleep again.*

IX.

THE HISTORY OF THE OPERATION FOR MOLLIFYING THE PARTS WHEN THEY BEGIN TO GET DRY OR FOR SUPPLYING AND MALAXING THE BODY.

HAVING already enquired into the internal methods of supplying the body, which proceed by many windings and turnings, in respect both of the aliment and the detention of the spirits; and therefore necessarily operate but slow; we come next to enquire into the external and shorter ways of affecting the same thing.

In the fable of restoring Pelias to youth, Medea preparing for the operation, proposes to cut the old man's body to pieces; and then to boil it with certain simples in a cauldron. But

* The axiom above laid down, and the rule deduced from it, may afford a specimen of the method wherein the author here endeavours, and directs all other enquiries to proceed.

though, literally, some kind of coction may be requisite in such an intention; surely the body need not be cut in pieces for it. And yet some kind of cutting seems necessary, though not with a knife, but the judgment; for as there is a great difference between the consistence of the viscera and other parts, they cannot all be mollified the same way; but regard must be had to each of them respectively; besides what belongs to the general intention of suppling the whole mass of the body: of which in the first place.

And if the thing be possible; bathing, anointing, and the like, may conduce thereto. But we must not fondly imagine it performable, from what we see happen in the steeping and macerating of inanimate bodies; whereby they are rendered soft and tender, according to some examples formerly produced: for this operation is more facile upon inanimate bodies, because they attract and suck in fluids; but more difficult in animal bodies, because motion in them tends rather from the center to the circumference.

And therefore, the common emollient baths, in use, are of little service, or rather opposite to this intention; as they rather extract than insinuate; and rather loosen than confirm the texture of the body.

There are three properties required in the baths and unctions designed for this operation,

of duly and substantially supplying the body. 1. The first principal property is, that they consist of such things, as in their whole substance are similar to the body, and the human flesh; and at the same time bland, and nourishing from without. 2. That they have such things mixed with them, as by their subtilty of parts may gain entrance; and so convey and spread the nutritive virtue of the other ingredients along with themselves: and, 3. that they receive some small mixture of such things as are constringent, or strengthening; nor rough or austere, but balmy and cherishing; so that whilst the other two perform their operation, all exhalation from the body may, as much as possible, be prevented; which might otherwise destroy the malaxing virtue; and rather that, by constringing the skin, and closing up the pores, the motion towards the internal parts may be assisted and promoted.

What approaches nearest to the substance of the human body, is warm animal blood; but that conceit of Ficinus for restoring strength to old men, by sucking blood from the arm of a young one, is strangely empty: for what nourishes internally, ought by no means to be consubstantial or perfectly homogeneous with the body to be nourished; but of a somewhat lower and subordinate class, that it may be converted:

though for external application, the more similar the substance, the greater the consent.

It was antiently believed, that a bath of children's blood would cure the leprosy, and restore corrupted flesh; insomuch that certain kings have been envied by their subjects for this advantage. It is related that Heraclitus, for a dropsy, put himself into the warm belly of an ox, new killed; and the warm blood of kittens has been used for the erysipilas; and for renewing the flesh and the skin.

In amputations, or in great hemorrhages of a limb, it is of use to thrust the bleeding part, into the bleeding body of a beast new killed; for this acts powerfully in stopping the hemorrhage: the wounded part strongly attracting, and sucking to it, the warm blood of the creature, by consent; thus causing a regurgitation, a stoppage of the flux.*

In dangerous and desperate diseases, great use is made of live pigeons, cut asunder, and applied, one after another, to the soles of the feet; and this sometimes with wonderful success; the cause whereof is vulgarly assigned to their attracting the malignity of the distemper: but, in some measure, the remedy has an effect upon the head, and relieves the animal spirits. But as all these

* Is this certain?

kinds of bathing the parts, or besmearing them with blood, appear to us filthy and disagreeable; we should look out for others, which are less loathsome, yet full as serviceable.

And next to recent blood, the things most similar to the substance of the human body, are of the nutrimental kind; as the well fed flesh of oxen, swine, or deer, oysters, milk, butter, eggs, wheat-flower, and sweet wine, either sugared or mixed with honey.

The things to be mixed along with others, for procuring entrance and admission, are salts, especially bay-salt: and these may be used instead of all the rest. Wine also, that is full of spirit, proves a good introducer, and is an useful vehicle.

The constringents, of the character above required, are saffron, mastich, myrrh, and myrtle-berries; as being at once both unctuous and cherishing.

And out of these ingredients, such a bath, in our judgment, may be made, as we at present desire. But physicians, and posterity, may find still better expedients.

This operation may be rendered much more effectual, if such a bath, which we conceive the principal thing, be used; with the observance of these four directions: 1. that previous to bathing, the body undergo friction; and be afterwards

anointed with oil, made thick like paint, that the moistening heat and virtue of the bath may enter the body, rather than the aqueous part of the liquor. 2. That the bathing itself next ensue; and be continued for about two hours. 3. That after bathing, the body be coated over with a proper mixture of mastich, myrrh, gum tragacanth, saffron and diapalma; to keep in, as much as possible, the perspirable matter, till the softening matter be by degrees turned into a more solid substance: and that this be continued for twenty four hours or more. 4. And lastly, that when this coating is taken off, the body be anointed with oil, whereto a little salt and saffron is added; the bathing being repeated four days afterwards, with the other parts of the process, as before: and the course continued for a month.

During this course of mollifying, we judge it useful, proper, and suitable to the intention, that the body be well fed: kept from the cold air; and receive nothing in the way of drink, without warming. But this course is one of those things which we have not experienced; only set it down as what promises to answer the end: for having marked out the road, we deliver the traditory or illuminating lamp into other hands.

Nor ought the warm and cherishing applications, of the bodies of living creatures, to be omitted. Ficinus, without intending a jest, said,

that David might have had comfortable use of Abishag's lying on his bosom, had she not come too late. He should have added, that, after the manner of the Persian virgins, she ought to have been perfumed with myrrh, and other ingredients; not to please the more, but to increase the cherishing virtue expected from the warmth of her body.

Barbarossa, in extreme old age, had, by the advice of a Jewish physician, young boys continually applied to his bosom: in order to warm, cherish and preserve him: and some old men accustom themselves to apply young puppies, which is a very hot kind of creature, to their stomach at nights.

There goes a report, not unsupported in many respects, that certain persons of monstrous noses, have had the exuberant parts and bunches thereof pared down; and the nose trimed to a moderate size; then making an incision in the fleshy part of the arm, they have held the trimed nose therein for a time, and thence procured it handsome. If this account be true, it affords a remarkable instance of the consent between flesh and flesh; especially whilst alive.*

It would be too tedious to enquire after, and prescribe rules for, mollifying all the principal

* See the Chirurgical Operations of Taliacotius.

viscera; as the stomach, the lungs, the liver, the heart, the brain, the spinal marrow, the kidneys, the gall-bladder, the intestines, veins, arteries, nerves, cartilages and bones; as we are not now writing a practice, but only setting down indications for it.

X.

THE HISTORY OF THE OPERATION FOR DISCHARGING THE OLD JUICES, AND SUPPLYING THEIR PLACE WITH NEW; OR THE BUSINESS OF PERIODICAL RENOVATION.

THOUGH what we shall deliver upon this head, has in great measure been touched already; yet because the operation is capital, we will here treat the former matters again, with a more express view to it.

It is certain that draught-oxen, worn down with labour, being put into fresh pasture, recover tender and young flesh; as we find by eating of it: whence it manifestly appears no difficult thing to procure tenderness to the flesh. And it is likewise probable, that if the flesh be thus several times made tender, the effect may reach to the bones, membranes, and the like.

It is certain, that the usual courses of diet-drinks, consisting principally of guaiacum, as also of Sarsa, China and Sassafras; especially when long continued, and according to strict

rules; first attenuate, and then consume and waste the whole mass of juices; as plainly appears from hence, that they actually cure the venereal disease, even though grown so inveterate as to produce nodes in the bones; and corrupt and deprave the innermost fluids of the body: and again, because the persons who are rendered extremely lean, pale, and almost cadaverous by such kind of diet-drinks, presently afterwards grow fat, fresh coloured, and are manifestly renewed. And therefore we judge that such a course would be extremely serviceable to the present intention; being used once in two years, in the decline of age; and prove like casting the skin to the snake; or procure a kind of rejuvenescency.

And we are firmly persuaded, that repeated and familiar purging has a much greater power to prolong life, than exercise and sweating. This must be the case, if the former position be true; that anointing the body; blocking up the pores from without; excluding the air; and keeping the spirits from exhaling greatly conduce to longevity. For it is certain, that sweating and perspiration, not only evaporate and consume the superfluous and excrementitious humours and vapours; but with them also the good juices and spirits, which are not so easily repaired: whereas the contrary happens in purging, unless

very immoderate; as this operates principally upon the excrementitious humours. But the best purges for the intention, are those taken before meals; because they thus dry the body less: and therefore ought to be composed of such simples, as give little disorder to the stomach.

The intentions of the operations here proposed, we conceive to be just; and the remedies prescribed, very suitable to them. And though many of them may seem trifling and vulgar, yet a man would scarce believe with what degree of care and choice we have sat upon and examined them; that they might be not only well adapted, but safe and effectual. Experience, however, is what must prove, and carry this matter still farther. In all cases, the results of deliberate and prudent consideration, though ever so admirable in their effects, and excellent in their order; constantly appear but vulgar and obvious things when discovered.

SECT. IX.

THE HISTORY OF THE AVENUES OR LAST APPROACHES OF DEATH; IN PROSECUTION OF THE FIFTEENTH ARTICLE OF THE TABLE OF ENQUIRY.

We come next to enquire into the avenues of death; that is, into what happens a little before, a little after, and at the very instant a person dies: for as there are many ways which lead to death, we should understand in what common road they terminate; especially in such deaths as are occasioned by the impoverishment of nature, rather than by violence; though some regard must be had occasionally to the latter, by reason of the connection the one thing has with another.

There seem three requisites to the subsistence of a living spirit; viz. 1. A commodious motion. 2. A temperate coolness, or refreshment; and 3. A proper aliment. Flame appears to require but two of these: viz. motion and aliment; for flame is a simple, but spirit a compound substance; which is destroyed by approaching near to the nature of flame.*

* See Mr. Boyle's Works; Abridgm. vol. ii. p. 469, &c.

1. A less flame is deadened, extinguished, and destroyed by a greater and more powerful one, acting upon it; and the same holds yet stronger of spirits.

Flame is extinguished by too great a compression: as we see by inverting a glass upon a candle: nor will fire burn in a grate, when the fuel is pressed too close; without leaving some space between its parts.

Ignited bodies are likewise extinguished by compression: thus a red hot coal is presently put out, by strongly compressing it with a fire-shovel, or the foot.

But with regard to the spirits; if any blood or serious matter gets into the ventricles of the brain, it is sudden death.

So likewise, great contusions of the head cause sudden death; by compressing the spirits in the ventricles of the brain.

Opium, and other strong narcotics coagulate the spirits; and deprive them of motion.

Poisonous vapours, which are utterly abominated by the spirits, also cause sudden death; as we see in those kinds of deadly poisons that operate by what they call a specific malignity: for these give such an abhorrence to the spirits as to deprive them of motion; or disable them from striving against a thing so contrary to their nature.

So again, great fits of drunkenness, surfeiting and gluttony, sometimes cause sudden death; in which cases, the spirits are not so much oppressed by the density and malignity of the vapour, (as in opium, and malignant poisons) as by its quantity.

So likewise, extreme fear and sadness, especially when sudden; as upon hearing an unexpected disaster: sometimes occasion sudden death.

And not only too great a compression; but also too great a dilatation of the spirits proves mortal.

Great and sudden joys have frequently proved mortal.

Large evacuations, as upon tapping for the dropsy, when the water comes away in abundance; but more particularly great and sudden hemorrhages, are often followed by sudden death. And this seems to happen by the way of preventing a vacuity in the body; whilst all the fluids plentifully pour themselves out to fill up the emptied spaces; and among the rest the spirits themselves. And thus much for the motion of the spirits, compressed or discharged, so far as to cause death.

2. We next proceed to the want of coolness. Stoppage of the breath proves suddenly mortal; as in all suffocation and strangulation. And this

does not seem owing so much to the prevention of motion, as to the prevention of cooling; because air when too hot, though largely taken in, suffocates no less than a stoppage of respiration; as happens in such as are sometimes suffocated by going into close rooms, where charcoal fires have been kept for airing them, or drying the walls, that were newly plaistered or white-washed: which is a kind of death said to have befallen the emperor Jovinian,* and the like happens in bagnios, or dry bathings, when the hot room is over-heated: which was a thing practised in the death of Fausta, wife of Constantine the Great.

It is a very short time wherein nature performs the act of respiration; or discharges the air received into, and spoiled by the lungs: as desiring to take in fresh at least twenty times in a minute.

The pulsation of the arteries, and the systole and the diastole of the heart, is a motion three times quicker than that of respiration; whence if it were possible to stop this motion of the heart, without altering that of respiration, a more sudden death would ensue than by strangulation.

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* Several of later date have suffered this kind of death; by entering suddenly into rooms kept close, with charcoal fires in them.

But use and custom have a considerable force in this natural action of respiration; as appears, from the Delian divers, and fishers for pearl; who by constant practice can hold their breath, at least ten times longer than other men.

There are some animals, among such as have lungs, that can hold their breath for a longer, and others for a shorter time as they require a greater, or less degree of coolness, or refreshment.

Fish require less cooling than land animals; though they still require some, and are refreshed by their gills: and as land animals endure not a close and over sultry air; so fishes likewise are suffocated, when the surface of the water remains for a long time entirely frozen.

If the spirits be attacked by any heat, much greater than the natural, they are thereby dissipated and destroyed: for if they cannot sustain their own native heat, without being cooled and refreshed; much less can they endure a foreign one, that is more intense, as appears in burning fevers, where the heat of the corrupted juices exceeds the natural heat: so far as to dissipate and consume the spirits.

The want and enjoyment of sleep has also some relation to this refreshment; for as motion attenuates and rarifies the spirits, and thereby provokes and increases their heat; so sleep on

the contrary, appeases and quells their motion, and disorder. For though sleep strengthens, and promotes the actions of the less lively parts and spirits, and all motion to the circumference of the body; yet it in greater measure calms and dulls the proper motion of the living spirit. But men regularly require sleep once in four and twenty hours; and of five or six hours continuance at least; though there are sometimes found miracles of nature in this respect. Thus it is reported of Mecænas, that he slept not for a long time before his death. And so much for the want of coolness, requisite to the preservation of the spirits.

3. The third requisite, that of aliment, seems to regard the parts, rather than the living spirit: For it is easily believed, that the living spirit remains identically the same; without succession or renovation: but for the rational soul, it is certain that this comes not by propagation; and neither suffers death nor repair. Men likewise talk of a natural spirit, both in animals and vegetables; which differs as well essentially as formally, from the other; and from confounding these two together have proceeded the doctrine of transmigration; and numberless other false and fictitious notions, among the hereticks and the heathens.

The body in health, regularly requires a diur-

nal renovation by aliment; and can scarce, without detriment, suffer three days fasting: though use and custom may make great alterations in this respect. But want is easier endured in a languishing illness. And sleep in some measure supplies the place of aliment: as exercise, on the contrary, requires it more. There are some, however, though few, who have been found, in a very extraordinary manner, to live a considerable time without meat or drink.

Dead bodies, if not prevented by putrefaction, continue long without any considerable waste; but living ones, as we before observed, not much above three days, unless recruited by aliment: which indicates that quick consumption to be the effect of the living spirit, whilst it either thus repairs itself, or puts the parts into a necessity of repairing themselves, or both. And this seems confirmed by the preceding observation, that animals can somewhat longer endure the want of aliment by the use of sleep: but sleep is no more than the collection of the living spirit into itself.

A too large and continued effusion of blood; as sometimes happens from the hemorrhoides; sometimes by vomit, when certain internal veins are burst, or their mouths opened; and sometimes by wounds; causes sudden death: the venal blood supplying the arterial; and the arterial supplying the spirits.

It is a considerable quantity of meat and drink that a man by two meals a day, receives into his body; and much more than he discharges by stool, by urine, and by sweat. If this be not thought strange: as supposing that the other part may be changed into the juices of the body; yet let it be considered that this supply, though afforded twice a day, does not overload the body; and again, that although the spirits are recruited; yet these also do not immoderately increase in quantity.*

It is of no service to have aliment present, only in a remote degree; for it must necessarily be of such a kind, so prepared, and so applied, as that the spirits may act upon it. Thus a taper would not continue flaming, unless immediately fed with wax: nor can a man be well nourished by herbage alone. And herein consists the waste of old age; viz. that though there be no want of flesh and blood, yet the spirits are prepared in such a small and scanty proportion, and the blood and juices are grown so exhausted, dry and balmless, that they cannot supply the demands of alimentation.

Let us now sum up the requisites to life, according to the common and ordinary course of

* This leads up to the doctrine of insensible perspiration.

nature. 1. The spirits continually require, an expansive motion in the nerves and ventricles of the brain. 2. The pulsation of the heart is required sixty times in a minute. 3. Respiration, twenty times in a minute. 4. Sleep and aliment, once in three days. And, 5. A power of alimentation, suppose after eighty years of age. And if any of these requisites are wanting, death ensues. But there seem to be three more certain and evident avenues of death; viz. 1. Want of motion in the spirits. 2. Want of coolness, or ventillation. And 3. Want of aliment.

1. 'Tis an error to imagine, that a living spirit should be perpetually generated and extinguished, like flame; without being able to last for some considerable time. Even flame itself is not thus generated, of its own nature; but only because it acts among things that are not favourable to it; for one flame is durable in another: but the living spirit resides among things that greatly affect and delight it; and therefore as flame is a momentary, and air a permanent substance, the living spirit seems to be of a middle nature between both.

2. We observed at first setting out, that the present enquiry was not concerned with the decay of the spirits, occasioned by the destruction of the organs, through distempers and violence; though this also terminates in the same threa

avenues. And thus much for the form and nature of death.

There are two grand harbingers of death; the one detached from the head, the other from the heart, viz. convulsions, and a labouring pulse: for the mortal hiccup is a kind of convulsion. And the mortal labouring of the pulse has a remarkable quickness; the heart trembling towards the article of death, and almost confounding its systole and diastole. This dying pulse is also attended with a debility and lowness; and frequently a great intermission of the stroke: the motion of the heart then failing; or being no longer able to rise with strength and regularity.

Death is likewise preceded, and denoted near at hand, by great inquietude and tossing of the body; a catching unsteady motion of the fingers, as if to take up somewhat from the bed clothes; grasping hard, and holding strong with the hands; grinding of the teeth; a hollow voice; trembling of the under-jaw; paleness of the face; confusion of the memory; loss of speech; cold sweats; shooting out of the body in length; turning up of the whites of the eyes: an alteration of the whole countenance; or a pinching in of the nose; hollowness of the eyes; sinking of the cheeks; contraction and rolling of the tongue; coldness in the extreme parts; sometimes a discharge of blood, &c. shrieking, gasping, and

fetching the breath thick; falling of the lower jaw, and the like.

Upon death their follows a deprivation of all sense and motion, as well of the heart and arteries as of the nerves and limbs; an inability of the body to sustain itself erect; a stiffness and coldness of the parts; a loss of colour, and some time after, putrefaction and stench.

Eels, serpents, and insects, continue to move in all their parts, a long time after being cut asunder. Birds, likewise, flutter, for a while after their heads are struck off; and the hearts of animals will long continue to beat, after being separated from their bodies. I remember myself to have seen a man quartered and disbowelled, for treason; when his heart being thrown into the fire, it sprung upwards; first to the height of about a foot and a half, and then by degrees a less height, for the space, as I judge, of two or three minutes. There goes an ancient, and no improbable tradition of an ox, that lowed when his entrails were taken out. Yet this appears less certain than what is related of a traitor, who was heard to pronounce three or four words of a prayer, after his heart was separated from the body, and remained in the hand of the executioner. We judge this relation more credible than the former of the ox's lowing under the hands of the sacrificer; because the friends of

the persons publicly executed, usually fee the executioner, to perform his office with the utmost expedition, and not keep the malefactor long under torture: whereas there appears no reason why the like dispatch should be made in the case of sacrifices.

The following things are in use for recovering persons from apoplexies and faintings; many of whom, without relief, might die in the fit; viz. the exhibiting of spirituous cordial-waters; bending the body forwards; stopping and strongly compressing the mouth and nostrils; bending the fingers, backward, so as to give pain; twitching off some hairs of the head or beard; rubbing the parts, especially the face and extremities, briskly; the quick sprinkling of cold water upon the face; sudden and shrill noises; the applying of rose-water and vinegar to the nose, in case of fainting; and burning feathers or woollen cloth under it, in hysteric fits: but principally, the application of a heated salamander, shovel, or warming-pan bottom, near the head, is serviceable in fits of the apoplexy.

There are many examples of men left for dead, laid out, and even buried, who have yet come to life again. This has been discovered, in such as were buried, upon opening the ground soon after, and finding bruises and wounds on the head; from the struggling of the body in the

coffin. We had a late and very memorable example of this, in the person of that subtle schoolman, Johannes Scotus; who being buried in the absence of his servant, that seemed to have known him subject to such kind of trances; this servant, some time after, opened the grave, and found the body bruised and wounded. The like happened in our time, in the person of a player buried at Cambridge. And a certain gentleman once told me, that having a desire to know what hanging was; he, by way of curiosity, and without any ill design upon himself, resolved to make some trial of it; and to this purpose suspending a cord, and fastening it about his neck, he mounted a stool, and swung himself off; conceiving it in his power to recover the stool again, when he pleased: but he failed in his expectation; and was relieved by the assistance of a friend then present. Being asked, what he underwent in that condition? he answered, he felt no pain; but first perceived a kind of fire, and burning before his eyes; then an extreme blackness, or darkness; and lastly, a kind of pale, blue, or sea-green colour; which is also frequently perceived by persons in fainting fits. And a physician assured me, that by the use of frictions, and hot bathing, he had brought a man to life again, who hanged himself, and had continued hanging for half an hour. This physi-

cian farther declared, that he made no question of recovering any person hanged up for the same time; provided his neck were not broken by the fall, or stretch of the rope.*

SECT. X.

OF THE DIFFERENCES BETWEEN YOUTH AND OLD-AGE; WITH REGARD TO THE SIXTEENTH ARTICLE OF THE TABLE OF ENQUIRY.

THE scale, or progression, of human life is this: conception; quickening; birth; lactation; weaning; feeding by hand; dentition for the first time, at about two years old; beginning to walk; beginning to speak; dentition the second time, at about the age of seven; puberty about twelve or fourteen; capacity for generation; the menstrual flux; the growth of hair upon the legs and arms; signs of a beard; growth of stature to this state, and sometimes longer; perfection of strength, and agility of body; greyness and baldness; cessation of the menstrua, and power of generation; decrepid age; walking

* The instances of this kind should be carefully collected; in order to gain as much light as possible into the transaction at the point of death.

with a stick; death. The mind likewise has its several periods, though incapable of being described by the numeration of years; such as decay of memory, &c. of which more presently.

The differences between youth and age are these:—

In youth the skin is smooth and equal; but in old-age, dry and wrinkled; especially about the eyes and forehead.

In youth the flesh is soft and tender; but in old-age hard and dry.

Young men are strong and healthy; but old ones weaker, and slow of motion.

In youth the concoctions are well performed; but in old-age weakly.

In youth the viscera are soft and succulent; but in old-age dry and parched.

In youth the body is strait and upright; but in old-age bent, or curved.

In youth the limbs are firm and steady; but in old-age, relaxed and trembling.

In youth the humours are bilious, and the blood is hot; but in age the humours are aqueous and melancholic; and the blood is colder.

In youth there is a ready disposition to venery; but in old-age, a slower.

In youth the juices of the body are more balmy; but in age more crude and watery.

In youth the spirit is copious and turgid; but in old-age poor and little.

In youth the spirit is dense and fresh; in old-age more rarified, and eager.

In youth the senses are entire and lively; but in age dull and faulty.

In youth the teeth are strong and sound; but in age worn and decayed.

In youth the hair is always coloured; but in old-age, grey or white.

Youth is attended with hair on the head; but old-age, with baldness.

In youth the pulse is strong and quick; but in old-age fainter and slower.

In youth diseases are more acute and curable; but in old-age more chronical, and harder of cure.

In youth wounds heal faster; but in old-age slower.

In youth the cheeks are florid; but in old-age pale, or of a deep red, by reason of the blood thickening and settling in them.

Catarrhs are less frequent in youth; but more troublesome in old-age.

Nor can we recollect in what respect old-age improves the body; unless sometimes in corpulency: the reason whereof is obvious; because the body in old-age neither perspires freely, nor

assimilates kindly; whilst fat is nothing but a redundancy of the aliment, over and above what is discharged, or perfectly assimilated. Sometimes also there is an increase of appetite in old-age, through the acidity of the juices: for old men do not digest well. But physicians lightly attribute all the particulars above-mentioned, to the diminution of natural heat and radical moisture; which is an empty notion, of no use at all. Thus much is certain, that in declining age, coldness precedes dryness; and that the body, when in the highest pitch and perfection of its heat, declines to dryness; whilst coldness succeeds afterwards.

We are next to consider the affections and dispositions of the mind. When I was a young man, at Poictiers in France, I familiarly conversed with a young gentleman of that country, who was extremely ingenious, but somewhat talkative: he afterwards became a person of great eminence. This gentleman used to inveigh against the manners of old people; and would say, that if one could see their minds, as well as their bodies, their minds would appear as deformed as their bodies: and, indulging his own humour, he pretended that the defects of old mens' minds, in some measure, corresponded to the defects of their bodies. Thus, dryness of the skin, he said, was answered by impudence; hard-

ness of the viscera, by relentlessness; blear-eyes, by envy and an evil eye; their down-look and incurvation of the body, by atheism; as no longer, says he, looking up to heaven; the trembling and shaking of the limbs, by unsteadiness and inconstancy; the bending of their fingers, as to lay hold of something, by rapacity and avarice; the weakness of their knees, by fearfulness; their wrinkles, by indirect dealings and cunning, &c.

But, to be serious, young men are modest and bashful; old ones, not so tender of countenance.

Young men are generous and commiserating; but old ones close, and harder of heart.

Young men have a laudable emulation; but old ones an ill-natured envy.

Young men are inclined to religion and devotion; as being warm in themselves, and inexperienced in misfortunes; but old ones grow colder in piety, through want of charity, a long conversation with evils, and a hardness of belief.

Young men are resolute: old men more moderate.

Young men have a certain levity and instability; old ones a greater gravity and constancy.

Young men are liberal, beneficent, and lovers of their species; old ones are covetous, wise for themselves, and firm to their own interest.

Young men are full of hope and confidence; but old men diffident, and in most cases distrustful.

Young men have an easy and obliging carriage; but old men are churlish, peevish, and disdainful.

Young men are sincere, and speak their minds; but old men are cautious and reserved.

Young men affect great undertaking; but old ones take care of such things as are necessary.

Young men favour things present; but old ones rather affect former transactions.

Young men reverence their superiors; but old men censure them.

There are numerous other differences, which belong rather to morality than the present enquiry. Yet as old mens' bodies improve in some respects, so likewise do their minds: unless quite worn out: for example, though they are less ready at invention, they are stronger in judgment; and chuse such things as are safe and solid, before such as are specious and showy. They likewise improve in talkativeness, and the art of shewing themselves to advantage; and, becoming now unfit for business, reap the fruits of discourse: whence the poets aptly feigned the transformation of Tithonus into a grass-hopper.

SECT. XI.

IMPROVEABLE AXIOMS, OR VARIABLE CANONS, FORMED UPON THE PRECEDING HISTORY; FOR GIVING LIGHT INTO THE CAUSE OF THE CONTINUANCE OR DURATION OF LIFE, AND THE TRUE NATURE, OR FORM, OF DEATH.*

AXIOM I.

There is no consumption, unless what is lost by one body passes into another.

EXPLANATION.

There is no such thing as annihilation in nature; and therefore in all consumption, the parts

* This Section contains a kind of recapitulation, or concise abridgment, of the preceding history; drawn up with new enforcements, and set in a fuller light; whence a judgment may be the readier formed thereof. And certainly it must be a pregnant history, to afford such a number of axioms, that seem a little compendium of Natural Philosophy; at the same time that they unfold, and explain, some of the great mysteries of Life and Death. And hence also a tolerable judgment may be formed of the design of this part of the author's work, which was to receive a collection of still more perfect axioms, after they had been thoroughly verified, or rendered precisely just; at least so just as not to fail in practice.

consumed either fly off into the air, or are received into some adjacent body. Thus we see spiders, flies, ants, &c. included, and eternized in monuments of amber; though these are tender and dissipable bodies: but then there is no air in contact with them, for their parts to escape into; and the substance of the amber is so heterogeneous as to receive none of them. And the like effect, we judge, might be procured by burying wood, or the like, in quicksilver: but wax, honey, and gums, have this effect only in part.*

AXIOM II.

All tangible bodies contain a spirit, covered over, and inveloped with the grosser body; and this spirit it is that gives origin to consumption and dissolution.

EXPLANATION.

There is no known body, in the upper parts of the earth, without its spirit; whether it be generated by the attenuating and concocting power of the celestial warmth, or otherwise: for the

* These axioms require a considerable attention to perceive their full meaning and just value; a greater to improve and verify them, they may require it; and a greater still to explain them so as to render them universally intelligible: and draw them out into familiar rules of practice, for operating effectually in the grand design of prolonging life.

pores of tangible bodies are not a vacuum; but either contain air, or the peculiar spirit of the substance. And this spirit is not a virtue, an energy, a soul, or a fiction; but a real, subtile, and invisible body, circumscribed by place and dimension. Nor again is this spirit air, any more than the juice of the grape is water; but a fine attenuated body, of kin to air, though again, very different from it: for the grosser parts of the subject being of a sluggish and not very moveable nature, would endure to a long period, did not this spirit rouze, stimulate, undermine them, and prey upon the moisture of the body, and whatever else it can digest and convert into new spirit; till at length, both the spirit before included in the body, and that newly formed, gradually fly away together. This is excellently demonstrated from the diminution of the weight of dry bodies, through perspiration: for all that which flies away, was not spirit at the time of weighing the body; but was spirit when it flew off.*

* This instance we meet with in nuts, the stones of fruit, &c. where the kernel dries and withers, as the spirit perspires through the shell and outward coats; without the entrance or admission of the external air. This axiom relating to the spirits of bodies deserves a particular regard. And let not any modern discoveries be too rashly imagined to have set the doctrine of spirits aside; whereon, perhaps, the improvement of natural philosophy principally depends.

AXIOM III.

The avolation of the spirit of bodies causes dryness; but whilst this spirit is detained aud operates within, it either dissolves, putrefies, or vivifies the body.

EXPLANATION.

There are four processes of the spirit; viz. 1. that of drying, 2. that of dissolving, 3. that of putrefying, and 4. that of generating bodies.

Arefaction is not the proper operation of the spirit; but of the grosser parts, after the spirit is discharged: for upon this they contract themselves, partly to fill up vacuities; and partly through an appetite which homogeneous bodies have to unite; as appears in all bodies dried by age, and in the firmer bodies which are dried by fire; as bread, charcoal, bricks, &c.

But colliquation is a mere work of the spirits; and not performed without the animation of heat; whereby the spirits dilate themselves, yet without flying off; and insinuate and spread among the grosser parts; thus rendering them soft and fusible; as we see in metals and wax: for metals, and other tenacious bodies, are fitted to hold

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See the Sylva Sylvarum, under the articles *Nature, Spirit, Sympathy*, &c.

in the spirit; and to prevent its avolation when excited.

Putrefaction is a mixed operation of the spirit, and grosser parts; for when the spirit, which restrained and held the parts of a body together, is partly discharged and partly rendered languid, all things are dissolved, and return to their heterogeneous principles; for now the spirit contained in the body gathers to itself; the oily parts to themselves; the aqueous also to themselves; and the fæces to themselves; upon which necessarily ensues that cadaverous odour, that unctuosity, sliminess, and confusion of parts observable in putrefaction.*

Generation likewise, or vivification, is a mixed operation of the spirits and grosser parts; but in a quite different manner: for in this case the spirit is totally held in, (but still expands and moves itself,) whilst the grosser parts are not dissolved, but obey the motion of the spirit; whereby they are swelled, and thrust out into various figures: whence proceeds generation and organization. And, therefore, vivification is always wrought upon a tenacious, viscous matter, though soft and yielding; fit at once to detain the spirit, and yet gently yield thereto; as the spirit forms

* See the nature of putrefaction, in the Philosophical Transactions; or Boerhaave's Chemistry, Process 88.

its parts. And this appears in the matter of all vegetables and animals, whether generated in putrefaction, or from seed; in all which there manifestly appears a substance which is hard to separate, but easy to yield.

AXIOM IV.

All animate bodies have two kinds of spirits; viz. a lifeless spirit, such as resides in bodies inanimate; and a vital spirit, superadded to it.

EXPLANATION.

We formerly observed, that in order to procure long life, the human body should first be considered as a body inanimate, and unrepairable by aliment; and again, as a body reparable and nourishable: for the former consideration supplies the laws of consumption; and the second the laws of repair. We are, therefore, to understand, that all the parts of the body, the flesh, the bones, the membranes, the organs, &c. have each of them, whilst alive, such spirits diffused through their substance, as are proper to them respectively, when separated, and dead, and such as remain even in the carcass: but the vital spirit, though it presides over, and has a certain agreement with them, is yet a very different thing; as being entire, and subsisting of itself.

There are two principal differences betwixt the lifeless and the vital spirits; the one, that the lifeless spirits are not continued in themselves, but in a manner cut off and surrounded by the gross body that intercepts them; like air mixed in among snow or froth: but all the vital spirit is continued in itself, through certain canals, which it penetrates without being totally intercepted. And this spirit also is of two kinds; the one only branching out, and striking through little tubes, and, as it were, single threads: but the other has also certain cells; so as not only to be continued with itself, but likewise copiously collected, in proportion to the body, into cavities which serve as fountains to numerous rivulets running from them. The principal cells, or cavities, of this kind, are seated in the ventricles of the brain; which in the more ignoble creatures are narrow; so that their spirit seems diffused over the whole body, rather than contained in cells; as appears in serpents, eels, and flies, which, when cut to pieces, long continue moving in all the separated parts: even birds continue struggling for a while, after their heads are off; because they have little heads, and little cells of spirits. But the more noble animals have these ventricles still larger; and man the largest of all.*

* Let these axioms and explanations by no means be lightly censured, and rejected as conjectural things; they

The other difference between the spirits is, that the vital spirit has some kind of inflammability, and resembles a breath composed of flame and air; as the juices of animals contain both oil and water. And this kind of inflammability is attended with peculiar properties and motions; for even inflammable smoke is warm, subtile, and moveable, before it catches fire, and turns to flame; yet becomes a different thing when changed to flame. But the kindling of the vital spirits is, by many degrees, more gentle than the softest flame, even that of spirit of wine: and is also largely mixed with an aerial substance, so as to become a peculiar and almost inexplicable union, of a flamy and aerial nature.

AXIOM V.

All the parts of the body have their proper and respective natural actions; but each of them is excited and quickened by the vital spirit.

EXPLANATION.

The actions or functions of any part are correspondent to the nature of that part; such as attraction, retention, digestion, assimilation, separation, excretion, perspiration; and even the

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are meant to be deduced from the preceding history, in the strict and genuine way of interpreting nature.

senses themselves, according to the properties of every organ; as the stomach, heart, spleen, brain, ear, eye, &c. Nor could any of these actions be excited and performed without the animating vigour and presence of the vital spirit, and its heat; no more than one piece of iron could attract another, unless first animated by the loadstone; or an egg produce a chick, unless the substance of the hen were first actuated by the treading of the cock.

AXIOM VI.

The lifeless spirits are nearly of the same substance with air; but the vital spirits approach nearer to the substance of flame.

EXPLANATION.

The explanation of the preceding fourth axiom, is also explanatory of this. But hence it is, that all fat and oily substances continue long in their own state; as the air does not greatly operate upon them, nor they themselves greatly incline to mix with the air. But that is an empty conceit which supposes flame to be kindled air; for flame and air are as heterogeneous as oil and water. The sense of the present axiom therefore is, that the vital spirits only approach nearer to the substance of flame than the lifeless

spirits do; and not that they are more of a flamy than aerial nature.

AXIOM VII.

Spirit has two appetites; the one an appetite of multiplying itself; the other an appetite of quitting the body, and associating with substances of its own nature.

EXPLANATION.

This axiom is understood of the lifeless spirits; for as to the second appetite, the vital spirit has a great abhorrence of quitting the body; nor can it find substances of its own nature near at hand: it may sometimes perhaps rush to the extremities of the body, to meet a thing it affects; though it is averse to going out. But both these appetites reign in the lifeless spirits. As for the first; no spirit is commodiously lodged among gross bodies; and therefore when it finds nothing of its own nature, it labours so much the more, in this solitude, to multiply itself, or to create, or produce its like; and thus briskly preys upon the more subtile parts of the gross bodies, in order to increase its own quantity.

As to the second appetite; that of escaping, and flying off into the air; it is certain, that all attenuated bodies, which are ever moveable, willingly move to their like, when near adjoining;

as flame to flame; and one bubble of water to another: but this happens much more in the avolation of the spirits into the external air; as not tending only to particles of a like nature; but, as it were, to an ocean of matter homogeneous to itself. Let it however be observed, that the exit and escape of the spirit into the air is a double action; proceeding partly from the appetite of the spirit, and partly from the appetite of the air: for the common air is a hungry thing; and greedily drinks in and receives spirits, odours, rays of light, sounds, &c.

AXIOM VIII.

When a spirit is detained, and finds no possibility of producing more spirit; it mollifies even the grosser parts.

EXPLANATION.

New spirits are only produced upon such things, as approach, in a tolerable degree, to spirit; as humid bodies do: and therefore if the grosser parts wherein the spirit lodged, are far removed from this degree; though the spirit cannot work, and convert them into its own nature, still it saps, softens, and resolves them; and though it cannot thus increase its own quantity, yet it resides therein more loosely, and lodges

among such parts as are most favourable to it. And this axiom is extremely conducive to our purpose; as leading to a method of mollifying the stubborn and dry parts of the body, by keeping in the spirits.*

AXIOM IX.

The business of softening the harder parts, is best carried on, when the spirit neither flies off nor begets a new supply.

EXPLANATION.

This axiom solves the difficulty in the operation of malaxing, by detaining the spirit; for if the spirit, being detained, should prey upon all within, there is no advantage procured by supplying the parts in their substance; but they are rather dissolved and corrupted thereby: and therefore besides detaining the spirits, they must also be cooled, and constringed, to prevent their too great activity.

AXIOM X.

The heat of the spirit, for preserving the body in a fresh and youthful state, ought to be robust; but not sharp, or predatory.

* Observe, all along, that practice is the end at which the whole enquiry, and these axioms drive.

EXPLANATION.

This canon also has a tendency to solve the difficulty above mentioned; but is also of much more extensive use; as describing what ought to be the temper of heat in the body, to dispose it for long life. And this temper of heat is proper, whether the spirits be kept in or not: for in either case their heat should be such, as may rather act upon the solids, than prey upon the fluids; as the former mollifies, but the latter dries up. The same temper, also is of service in the due performance of alimentation; as such a heat best excites the faculty of assimilating; and at the same time excellently prepares the matter for assimilation. The properties required in this heat are: 1. That it be slow, and do not act of a sudden; 2. That it be not intense but moderate; 3. That it be equable, not acting unsteadily, or by fits of increase and decrease; and 4. If it find any resistance, that it should not easily grow languid, or become extinct. This is an operation of great subtilty, and of no less use: We have therefore had a regard to it; and hope, in some measure, to have answered the intention, by the remedies, above proposed, for giving the spirits this robust, unconsuming and effective heat.

AXIOM XI.

A condensation in the substance of the spirits is conducive to long life.

EXPLANATION.

This axiom is subservient to the former; as a dense spirit admits all the four properties of heat there mentioned. But for the ways of condensing the spirits, we have described them above, under the first of the ten operations.

AXIOM XII.

When the spirits are copious, they hasten to escape faster, and prey upon the body, more, than when their quantity is small.

EXPLANATION.

This axiom is clear of itself; since quantity, of course, increases efficacy. And we see in flames, that a greater breaks out more forcibly, and consumes its fuel swifter than a small one: and, therefore an over proportion, and a redundancy of spirits is prejudicial to long life. Nor should a larger quantity of spirits be desired, than may support the offices of life; and secure a good repair.

AXIOM XIII.

A spirit equally diffused through the body, hastens less to escape, and consumes the body slower, than when unequally distributed.

EXPLANATION.

Not only an over-proportion of the spirits, with regard to the whole, shortens the duration of things: but also the same quantity less ground or broken: and therefore the more spirit is comminuted, and dispersed through the finer vessels and fibres; the less it consumes. For resolution and decay always begin in the part, where the spirit is weak or wanting; and therefore exercise and frictions contribute much to long life. For all motion and agitation excellently grind, and intimately mix things together in their smallest particles.

AXIOM XIV.

An irregular and subsultory motion of the spirits, tends more to their escape, and proves more consuming, than a motion that is constant and equable.

EXPLANATION.

This axiom holds with certainty in bodies inanimate; for unequability is the parent of dis-

solution: but in inanimate bodies it holds less strictly; because in these there is not only a consumption, but a repair to be considered: and repair depends upon the appetite of things; and appetite is sharpened by variety. But here also the axiom may be admitted so far, that this variety should rather be a regular interchange than a confusion; and as it were a constant inconconstancy.

AXIOM XV.

The spirit is detained in bodies of a firm and close texture, though unwillingly.

EXPLANATION.

All things dread a solution of their continuity; though this according to their degree of condensation or rarifaction: for the more bodies are rarefied, the lesser pores they will pass, or be driven through by compression. Hence water and air will enter where dust will not; and flame and spirit, where air and water will not. But this matter is limited; for spirit has not so strong an appetite of escaping, as to suffer too great a discontinuation; or be driven through pores that are too close and strait: and therefore if spirit be lodged in a hard body, or such a one as is unctuous, and viscous, that will not easily sepa-

rate, it is then withheld, imprisoned, and exerts not its appetite of escaping. Whence we see that metals and stones will not, for a very long time, let go their spirit, unless it be either excited by fire; or the grosser parts of those bodies be separated, and disjoined, by corrosive liquors. And the like holds of tenacious bodies, such as gums; only these are dissolved by a gentler heat. And therefore, robust juices of the body, a constringed skin, and the like, (which are procured by a drying aliment, exercise, and cold air), prove serviceable in prolonging life; by shutting up the pores upon the spirit, and preventing its escape.

AXIOM XVI.

The spirit is willingly detained in fat and unctuous bodies; though they be not viscous.

EXPLANATION.

If the spirit be neither irritated by any antipathy it has to the body that surrounds it; nor fed by too great a similitude with the subject itself; nor solicited by any thing external; it becomes not very tumultuary to get out, but oily bodies want all these properties; as being not so opposite to the spirit, as hard bodies are, nor having such an affinity thereto, as aqueous ones

have; nor greatly agreeing with the external air.*

AXIOM XVII.

Oily bodies are long preserved in a state of perfection, by a quick discharge of their aqueous moisture.

EXPLANATION.

We just now observed, that aqueous moisture, as approaching nearer to the substance of the air, flies off faster than such as is oily: which has a less agreement with the air: but as both these moistures are lodged in most bodies, it happens that the aqueous betrays the oily moisture; and gradually escaping, carries that away along with itself; whence nothing is more conducive to the preservation of bodies than to dry them gently; which breathes out the watery parts, without disturbing or affecting the oily. And this not only tends to prevent corruption; as it does by consequence; but also to preserve bodies in a fresh and vigorous state. And hence it

* It may be well worth considering how extensive this axiom is; and how it agrees with the ancient and later discoveries, as to the native spirits of bodies. See, in particular, the processes upon vegetables, in Boerhave's Chemistry. See also process 121.

is, that gentle frictions, and moderate exercise, used so as to promote perspiration rather than sweat, greatly conduce to prolong life.

AXIOM XVIII.

To exclude the air from the body, contributes to longevity; if other inconveniencies be prevented.

EXPLANATION.

We lately observed,* that the escape of the spirit is a double action, arising from an appetite both of the air, and spirit; it is therefore of considerable service, if one of these appetites can be destroyed. This is chiefly to be expected from unctions: but the use thereof is attended with various inconveniencies: which we have endeavoured to prevent under the second of our ten operations.

AXIOM XIX.

By introducing juvenile spirits into an old body, the course of nature may be expeditiously put back.

EXPLANATION.

The spirits are like the master-wheel, that carries the other wheels round in the body: and

* See axiom vii.

therefore these ought to stand first in the intention of prolonging life. We may add, that there is an easier and more compendious way of altering the spirits than the other parts: for the operation upon the spirits is of two kinds; the one by aliment, which is slow, and effected by a circuit; the other by vapours, which is sudden, and reaches the spirits directly and immediately. To this also may be added, the way of operating by the affections, or passions of the mind.

AXIOM XX.

Hardness or firmness, and roscidity or balminess in the juices of the body, contribute to prolong life.

EXPLANATION.

The reason hereof is plain; since as we have above observed, hard or firm, and balmy or unctuous bodies, are dissipated with difficulty. There is however this difference, that though hardish and firm juices are less dissipable, they are at the same time less reparable; which adds an inconvenience to a convenience; and therefore nothing extraordinary can be performed by means of hard juices: but a balmy juice will answer both intentions; and therefore great regard must be had to the procuring of it.

AXIOM XXI.

Balmy juices are procured by such things as penetrate, through their subtilty or fineness of parts; yet corrode not by their acrimony.

EXPLANATION.

This axiom, or the canon it affords, is easier to understand than to practice: for it is plain, that whatever penetrates kindly, but at the same time has a stimulating virtue or pungency, (which is the case of all acid and biting things), leave, wherever they pass, some impression of dryness or corrosion; so as to indurate the juices, and vellicate the parts: whereas such as penetrate by mere subtilty, steal in and insinuate themselves, without violence; whilst they moisten and bedew the parts in their passage. And some such remedies as these, we have described under the fourth and seventh of our ten operations.

AXIOM XXII.

Assimilation is best performed upon the cessation of the local motion.

EXPLANATION.

This axiom stands sufficiently explained by what is delivered under our eighth operation.

AXIOM XXIII.

External alimentation, at least such as is not performed by the stomach, if it could be procured, would prove very serviceable in prolonging life.

EXPLANATION.

We see that every thing performed by nutrition, is performed by long circuits; but much quicker by the way of imbibing a similar substance, as in the case of infusions: a method, therefore, of alimentation from without, would be extremely useful; the rather because the digesting faculties fall off, and fail in old-age. Whence if there could be any auxiliary ways of nutrition contrived, by bathing, anointing, or by glysters; they might prove serviceable, by a proper conjunction of some of them, which separate would be of less significance.

AXIOM XXIV.

Where concoction is weak, so as not to protrude the aliment, the external parts should he excited; in order to attract the aliment outwards.

EXPLANATION.

The sense of this axiom is not the same with that immediately foregoing; for it is one thing

to attract the aliment inwards, and another to draw it from within outwards: though they both agree, in supplying the weakness of the internal concoctions another way.

AXIOM XXV.

All quick renovation of the body, is procured either by the spirits, or by malaxing.

EXPLANATION.

The body consists of two things; spirits and tangible parts; both which are but slowly reached by nutrition: whilst the short way to the spirits is by vapours, and the passions of the mind; and to the parts, by supplying and mollifying applications. But we must well distinguish between alimentation by external means, and malaxing: for the intention of malaxing is not to nourish the parts; but only the better to prepare them for being nourished.

AXIOM XXVI.

Malaxing is performed by substances similar to the body: substances that insinuate into it; and substances that close it up.

EXPLANATION.

It is evident, that similar substances to the

body, are properly mollifying; whilst such as easily insinuate, help others forward; and such as close up or constringe, help to keep in and prevent perspiration, which is a motion opposite to malaxing. This operation, therefore, cannot be well performed at once; but should be attempted in a series and method: 1. By excluding the liquor externally applied for the purpose, in the way of coating the body over with some thick unctuous matter: because all extraneous and gross immersion, as in common bathing, does not well consolidate the body; but what is designed to enter it, should be subtile, and a kind of vapour; according to the observation delivered in our ninth operation. 2. By mollifying, through a consent of substances of like kind; for bodies open themselves, and relax their pores, when they come in contact with things very agreeable to them, 3. By using proper insinuating matters as vehicles, that in some measure may convey and carry forwards the substances of like nature with the body: These vehicles also being lightly impregnated with gentle constringents, that at the same time may a little check and prevent perspiration. And, 4. B following these operations with a great astriction, or shutting up of the pores, by an emplastic coating; and afterwards gradually by anointing; till

the mollifying matter acquires some degree of solidity.

AXIOM XXVII.

A frequent renovation of the reparable parts, renews also the parts that are less reparable.

EXPLANATION.

We observed, in our general introduction to this history, that in the natural progress of death, the more reparable parts perish in the embraces of the parts less reparable; and that the utmost efforts were to be used for repairing these less reparable parts. Admonished, therefore, by the observation of Aristotle upon plants, where he says that the shooting out of new branches causes also a renewal of the trunk, by the passage of the new juices through it; we judge the case might be the same, if the blood and flesh of the human body were frequently renewed; and that the membranes and other parts, even the bones themselves, though less reparable in their own nature, might be refreshed, recruited, and renewed: partly by a brisk passage and circulation of new juices in them; and partly again by the new clothing, of recent flesh and blood, brought upon them.

AXIOM XXVIII.

That kind of cooling, which does not pass by the stomach, is conducive to long life.

EXPLANATION.

The reason is obvious; as not a temperate, but a powerful degree of coolness, especially in the blood, is a principal requisite to long life: which coolness cannot be procured in the necessary degree, by any thing taken at the mouth; without prejudice, and destruction, to the stomach and viscera.

AXIOM XXIX.

This complication, that both consumption and repair are the operations of heat is the greatest obstacle to long life.

EXPLANATION.

Most great works are prevented or destroyed by complicated natures; what proves serviceable in some respects, proving prejudicial in others: so that a consummate judgment, and a discreet practice, are here required. This we have, so far as the subject allows, and our present thoughts can reach, endeavoured after; and done our utmost to separate the benign and fa-

vourable heats from such as are unkindly or hurtful; and given our directions and cautions with regard to both.

AXIOM XXX.

The cure of diseases requires temporary medicines; but long life can only be expected from a regimen and diet.

EXPLANATION.

Those things that happen by accident cease upon removal of their causes; but the course of nature is a continued thing, which, like a rapid river, requires to be continually rowed against: whence to prolong life, we must work regularly by a regimen. Regimens are of two kinds; 1. stated; or to be observed at certain times; and 2. familiar; which should be brought into daily use. But stated regimens, or a series of remedies continued for a season, are the most powerful. For things, of that efficacy as to turn nature back in her course, must generally be stronger and productive of more sudden alterations, than those that can, with safety, be brought into frequent and familiar use. Our intentional remedies turn but upon three stated regimens; viz. 1. the opiate regimen; 2. the malaxing regimen; and 3. the discharging, and renovating regimen.

Among the most effectual things prescribed, in our familiar and daily regimen, and which almost equal the force of stated regimens, are 1. nitre and its substitutes; 2. the government of the passions, and regulating the kinds of study; 3. methods of cooling, that pass not by the stomach; 4. balmy drinks; 5. the impregnation of the blood with a firm substance, as that of pearls or wood; 6. proper unguents to exclude the air, and keep in the spirits; 7. proper external methods of heating, during the time of assimilation, after sleep; 8. a cautious use of such things as inflame the spirits, and give them a sharp consuming heat; for example, wines and spices; and, 9. a moderate and seasonable use of such things as give a robust heat to the spirits; for example, saffron, cresses, garlic, ellicampane, and compound opiates.

AXIOM XXXI.

Flame is a momentary substance; air a fixed substance: but the vital spirit of animals, is a middle substance, betwixt both.

EXPLANATION.

This is a matter of deep enquiry; and requires a larger explanation than belongs to the present subject. Let it be observed, however, that

flame is continually generating and dying: so as to exist only in succession. But air is a permanent body that does not perish; for although new air be generated from aqueous moisture, yet the old air still remains: whence proceeds a surcharge of air.* The vital spirit participates of both natures; and is at once flamy and aerial. And accordingly its pabulum or fuel, are oil and air; the oil being homogeneous with flame, and the air with water: for spirit is not fed, or nourished by oil alone, or by water alone; but by both. And though air neither comports well with flame, nor oil with water: yet they suit in mixture or composition. Again, spirit has its ready and delicate impressions from the air; but its noble, powerful, and active motions from flame. So, likewise, the duration of spirit is a compound duration; not so momentary as that of flame, nor yet so permanent as that of air. It differs also so much the more from flame, because flame is extinguished by accident or by contraries, and the surrounding bodies that destroy it; but spirit, has no such cause nor necessity of its destruction. Lastly, spirit is repaired, or recruited, from the vivid and florid blood of the finest arteries; which creep along

* See more of this in the ensuing History of Winds.

the brain. But this repair is made in its own peculiar manner; that comes not now to be considered.

AXIOM XXXII.

The vital spirit is immediately destroyed, upon being deprived of motion, coolness, or aliment.

These three things we call the avenues of death; and they are the proper and immediate passions of the vital spirit: for all the organs of the principal parts serve to perform these three offices; and all the mortal destructions of the organs terminate in one or more of them: whence the rest are but different paths to death; that end at last in these three grand roads or avenues. But the whole fabric and structure of the parts, is the organ of the vital spirit: and this spirit itself is the organ of the rational soul; which is incorporeal and divine.*

* When the whole of this enquiry shall be duly prosecuted, and completed, the number of these axioms may perhaps be considerably lessened; or included under others more general, and a few sure rules discovered, for advantageously lengthening the present period of life: which we wish were not so generally looked upon as a subject beyond the reach of men.

A SHORT
SCIENTIFIC CRITIQUE,

ON THE

WORKS OF THE MORE EMINENT PHILOSOPHERS,

ANCIENT AND MODERN.

PREFACE.

THE following is an imperfect piece, found among the posthumous Scripta, published by Gruter. But, imperfect as it is, it will, perhaps, be esteemed by competent judges of no small value; as tending to free mankind from the tyranny of great names, and leave us at liberty to follow nature.

What particular use the author designed it for, or in what part of his works he would have introduced it, had he lived to revise and finish it, I cannot say: but it manifestly appears, by the whole tenour, to have an eye to the Novum Organum; up to which it directly leads. It might, therefore, have been properly placed at the entrance of that work; were it not required as a supplement to the De Augmentis Scientiarum.*

It may be reasonably supposed, that many of those who have read the works of the philosophers censured by the author, will not perceive the justness of the censures. A cursory reading of them is not sufficient for this purpose: It requires an intimate knowledge of nature, and of what men, by proper application, are capable of performing, to judge of the validity or invalidity of the ancient and modern philosophies.

* See this work, Sect. XIX, of *Criticism*.

Besides, if we would not flatter ourselves, we lie under a kind of incantation, from prejudice, pre-possession, and custom, with regard to great names, and authors, celebrated through numerous ages; whence some of us cannot, though we strongly desired it, use a freedom and justness of thought in this matter. But those who are most themselves, and can here exercise a free and independant judgment, will, perhaps, perceive that the author, with a few master-strokes, has drawn the ancient philosophers, and their modern followers, to a truth; and wish the work were continued down to later times, to shew us, as in one picture, what it is that the great men of all ages have busied themselves about.

CRITIQUE,

OF THE MORE

EMINENT PHILOSOPHERS, &c.

SECT. I.

THE ARRAIGNMENT OF THE PHILOSOPHERS.

WE plainly perceive, that the sciences will not be considerably advanced, till men shall be once made thoroughly acquainted with the proper characters and merits of those ancient and modern philosophers they so much admire. The present design is, therefore, to deal roundly; and fix a mark upon such pretended philosophers as we take to have been more fabulous than the poets; debauchers of mens' minds, and falsifiers of the works of nature,* and to make, at least,

* These expressions will lose of their strangeness, if the reader be acquainted with the author's pieces, de Augmentis Scientiarum, and Novum Organum.

as free with that degenerate, servile tribe, their followers, flatterers, and the hirelings, who corrupt mankind for gain.* And we shall take the liberty to cite each of them by name; lest, as their authority is so great, we should be apprehended only to act a part; and, under colour, side with some or other of them;† since they cherish such violent disputes and animosities among themselves.

Let Aristotle first appear; whom we charge, 1. with abominable sophistry; 2. useless subtilty: and, 3. a vile sporting with words. Nay, when men, by any accident, as, by a favourable gale, arrived at any truth, and there cast anchor; this man had the assurance to fetter the mind with the heaviest irons; and composing a certain art of madness,‡ enslaved mankind with words.

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* This aims at professory institutions; destined to teach the philosophy of Aristotle, suppose, or any other author, instead of the philosophy of nature.

† The candor and impartiality of our author seems every where preserved. Thus, though he, even in his youth, perceived the vanity, and small significance of Aristotle's philosophy; yet he omits no occasion of recommending such particulars in it, as are any way just and useful. The same conduct he preserves with regard to other founders of sects, &c. so as to be deservedly esteemed the father of the modern eclectic philosophy.

‡ Calmly to view the several systems of philosophy that have prevailed in several ages; what are they more than so

Again, from the nursing and tutoring of this man, have arisen a shoal of cunning triflers; who, turning their backs upon nature, and all the light of things and history,* overspread the world with numerous mock-schools; raised, by the restless agitation of wit, principally upon that extremely ductile matter of his precepts and positions.† But they, indeed, are more excusable than their haughty dictator; because they did not, like him, offend against better light and knowledge: For he, after having trod in the open plains of history, and viewed the works of nature,‡ yet dug to himself a dungeon, and filled it with the vainest idols.§ And, what adds to his guilt, he has, even upon the history of particulars, raised

many arts of madness? See the Novum Organum, Part I. Sect. I. &c.

* Without a metaphor, neglecting experience and observation.

† This explains the art of madness above-mentioned; for, as in natural madness, men argue upon things that have no existence or true foundation; so, in philosophical madness, we reason about things, whose history, or true state, we have no clear and certain knowledge of, from experiment and observation: but as madmen do, take all for granted, according to our frantic notions.

‡ Aristotle was for a time conversant in the history of nature; as appears particularly from his history of animals.

§ What these idols are, see in the Novum Organum, Part I. Sect. II.

certain cobweb structures, which he would palm upon mankind for causes; whilst, in reality, they are matters of no validity nor value; but nearly resembling those, which, in our time, that antipode to things, as well as to himself, Cardan, busied himself in forming.*

But whilst I thus arraign the works of Aristotle, let me not be supposed a conspirator, and in league with Ramus, that modern rebel against him. I have no affection for that sculking hole of ignorance, that destructive book-worm of learning, that father of epitomes, who, when he wrings and presses things with the shackles of his method, and contraction; the substance, if there was any, immediately starts out, and escapes him; whilst he grasps nothing but the empty chaff, and exhausted carcass.†

Aquinas has gone further, and spun a variety of things out of nothing; leaving by way of compensation, a solitude in things themselves. And although he has done this, yet he has the assurance to be frequently talking of human uses; so that I take him for a most prevaricating sophis-

* It requires, as was observed in the preface, a considerable knowledge in the works of Aristotle, to see the justness of these observations. And the same must be understood of all the following authors.

† See more to this purpose in the De Augmentis Scientiarum. Sect. XVIII of *Rhetoric*.

ter. And the same accusation I likewise bring against Scotus, and his followers.*

Let Plato next appear; whom we charge with being 1. a well-bred sophister; 2. a tumid poet; and 3. a fanatical divine; who, by finely polishing, and working together, certain philosophical rumours; and dissembling his pretence to knowledge; endeavoured to loosen and unsettle men's minds by vague inductions; and has thus indeed supplied abundant matter of table-talk to men of letters, in respect of civil conversation, polite life, ornament, and sweetness of familiar discourse. But when he falsely asserted, that truth was not an inhabitant of the human mind, but a stranger come from far; and turned men's thoughts from the history of nature, and from things themselves (though never sufficiently applied thereto); and taught the mind to enter into itself; and there, under the name of contemplation, to tumble over its own blind and confused idols†; then it was he committed the capital crime of which we accuse him. And no less impiously has he introduced the canonization of folly; and had the assurance to skreen his degenerate and corrupt notions under the

* See a farther account of the schoolmen, in the De Augment. Scientiar. Prelim. Sect. iii.

† See Nov. Organ. part. i. sect. ii.

cloak of religion. And here lies the strength of the charge. But for his being the father of philology, polite literature, and elegant writing, who by his example, authority and success, captivated, persuaded, and led numbers to content themselves with a character for wit, politeness, agreeableness, and a popular knowledge of things, to the detriment and corruption of a severe and rigorous enquiry after truth; we account this a less heinous offence. And among the men thus captivated by him we reckon Cicero, Seneca, and Plutarch, with numerous others no way comparable to them*.

Let us next proceed to the physicians; and first summon Galen to appear: whom we implead, 1. as a man of a very narrow mind; 2. a deserter of experience; and 3. an idle caviller. This is the man that would skreen the ignorance and sloth of physicians from their deserved reproach; and preserve them unattacked; whilst himself most feebly and unequally pretends to perfect their art, and fill up their office. This is the man, that, like the raging dog-star, or the plague, devotes mankind to death and destruc-

* Mere Platonists, or men of contemplation, must not here be the judges: but those well versed in physical knowledge, the doctrine of business, the wants of mankind, and the ways of supplying them.

tion, by pronouncing such tribes of diseases incurable; taking away all glimmering of hope, and leaving no room for future industry. This is the man, who makes his own fiction of mixture to be nature's sole prerogative. This the man, that is every where fond of shewing and boasting the sedition, strife, and disagreement betwixt the celestial and that of fire: and upon this, and all other occasions, maliciously curbs the human power; and endeavours to surround and protect ignorance with eternal despair. It is owing to this man's unworthiness, that we dwell no longer upon his charge. Let him then be dismissed; and take along with him his whole train of associates; those dispensatory compilers the Arabians, who have shewn such folly in their theories; and from their supine and jejune conjectures, amassed together such heaps of promises, instead of real helps, from vulgar remedies. And let the rear be brought up with that superficial tribe of modern doctors, whose names are not worth the mentioning.*

* Some sober physicians, who have read Galen with care, may, perhaps avouch, this character does not suit him. If so; let it be examined whether such physicians are acquainted with the imperfect state of physic in different ages and countries; whether they are sensible of its imperfections; and can lay down any solid scheme for improving it.

We must, however, make some difference in this tribe of triflers; the worst and most absurd sort whereof, are those who have pent the whole art into strict methods, and narrow systems, which men commonly cry up for the sake of their regularity and style: and such a kind of author is Fernelius. But they are less prejudicial to the art, and to mankind, who deliver a large stock and variety of observations, experiments, and particular cases, even though they pollute and obscure them with their absurd and foolish reasons, idle hypotheses and solutions; like Arnoldus de Villa Nova, and others of the same stamp.

On the opposite side stand the tribe of chemists, with Paracelsus at their head; who, for his insolence, deserves to be separately chastised, as a flagrant example: for those accused above are only falsifiers and pretenders; but this man is throughout a monster. What Bacchanalian oracles are those he utters in meteorology; whilst he is ridiculously aping of Epicurus? All that Epicurus offers upon this subject is but drowsy opinion, which he unconcernedly left to its fate; but Paracelsus, blinder than fate, and more rash than chance, is ready to avouch the absurdest falsehoods. What dreams of resemblances, correspondences and parallels of the productions of his elements, are given us by this fanatical linker-

together of idols? His three principles, indeed, might be received with some utility; as having a foundation in nature: but he is continually wresting them to every thing according to his great dexterity in delusion and imposture. But these are not the worst of his crimes: For, besides all this, he, like a sacrilegious impostor, has mixed and polluted divine things with natural; sacred with prophane; fables with heresies; and human truths with religious; so as not, like the ancient sophists, to have hid, but utterly extinguished that sacred thing he has so frequently in his impious mouth, the light of nature. The sophists were only deserters of experience, but Paracelsus has betrayed it; and subjecting the crude and personated evidence of things to rules of contemplation, and deriving the various alterations of substances from imaginary motions; he has thus endeavoured to corrupt the fountains of science, and dethrone the human mind. At the same time, so far is he from understanding, or justly representing experience, that he has added to the trouble and tediousness in experimenting, of which the sophists complain, and to which the Empirics are unequal. In short, he has every where, to the utmost, magnified the absurd pretences of magicians; countenanced such extravagancies; and encouraged others to believe

them, from his own assurances; being thus, at once, the work and servant of imposture.*

It is great pity he should ever have found such an abettor and apologist as Severinus; whose abilities might have been much better employed, than upon the fooleries of that man. It is Severinus, who has modulated the brayings of that ass†; and by his own skill in music, played then sweetly off in a variety of tunes: and thus converted shocking and monstrous fictions, and falsehoods into pleasing and delightful fables. This author, indeed, is the more excusable, in that, being sick of the doctrine of the sophists, which is not only barren of works, but professedly tends to introduce despair, he went in quest of firmer foundations, in this general decay of philosophy and the arts. And thus when the

* The Paracelsits will, doubtless, be for interposing here: But they are excluded by the condition of the enquiry. They must have better talents, and greater knowledge than their master, before they can judge of his merits.

† The reader will please to remember, that this piece is imperfect, and in the original delivered under an uncertain form; sometimes by way of advice to a son, and sometimes in the form of pleading: which latter form we have endeavoured to keep to; as admitting a greater freedom of expression. The author was too well bred to use any coarse or vulgar language. What, therefore, may appear of this kind, must be supposed spoke under the veil of fiction.

works of Paracelsus offered themselves, and came recommended with pompous shew, the subterfuge of obscurity, affinity with religion, and other impostures, Serverinus gave into them, delivered not the real fountains of things, but only threw out promises and hopes, with somewhat of warmth and indignation: whereas, would he have acted as he ought, he should have left the determinations and maxims of wit and genius, and gone over to the real doctrines and precepts of nature; which alone is the way to shorten arts, and lengthen life.*

This charge we have brought against Paracelsus seems to astonish the rest of the chemists; who greedily swallow those decrees and points of doctrine which he has rather promulgated and promised, than actually laid down; or made good; and defended them with arrogance instead of caution. His whole tribe of followers appear linked to one another by the lying spirit that shews itself in their swoln hopes and promises; which they are constantly boasting. However, by wandering through the wilds of experience, they sometimes stumble upon certain useful dis-

* Without some knowledge of the works of Severinus, the force and justice of what is here said will not be understood. The author appears to have had all the works he here censures strongly impressed upon his mind.

coveries; not by reason, but by accident:* whence, proceeding to form theories, they plainly carry the smoak and tarnish of their art along with them. For as that simple youth, who finding a stick upon the shore, would needs convert it into a ship; so these childish operators at the furnace must needs be raising philosophy from a few experiments of distillation; and introducing, at every turn, their own idols of separation and analysis, where no traces of them are really found.†

Yet we do not accuse them all in the lump; but make a difference between that little serviceable set, who, being not very solicitous about raising of theories, principally practise a certain mechanical subtilty in searching out, and laying hold of new inventions, and discoveries; with their extensive uses; after the manner of friar Bacon;‡ and distinguish these from that impious tribe, who endeavour only at procuring applause to their theories, and court and beg it by a pretended zeal for religion, by large promises, and

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* See de Augmentis Scientiarum, Sect XII. of *Learned Experience.*

† This general censure of the chemists appear extremely just.

‡ Add to him, as capital authors and actual inventors of later date, the Lord Verulam, Mr. Boyle, Becher, Homberg, and Stahl.

the art of imposture; which is the way of Basil Valentine, Hollandus, and much the greatest part of the chemical authors.*

Let Hippocrates be next called to the bar; whom we arraign 1. as a creature patched up of antiquity; and 2. a retailer of other men's knowledge; under whose authority, both Galen and Paracelsus ridiculously endeavour to shelter themselves, like asses under a tree.† To do him justice, he seems to have had his eyes at first perpetually fixed upon experience;‡ but then they are fixed indeed, stupid and immoveable, without ranging, and searching for noble, manly, and full views: and afterwards, recovering a little from this stupidity, he takes in certain idols;‖ though not those monstrous ones of theories, but such as are more neat, elegant, and surround the limits of history; and having drank these in, he becomes swoln, sophistical; and, according to the custom of the age he lived in, wraps himself up in brevity; and thus, as his followers imagine

* It may appear surprising, that the author should have known the chemists so well, as to judge and distinguish thus accurately between them.

† See the note upon Sect. 7, above.

‡ The author's censure of Hippocrates requires a reader of extensive knowledge, free from prejudice, and well broke to the self-denying doctrine of the Novum Organum.

‖ See the Novum Organum, Part I. Sect. II.

utters oracles, of which they are ambitious of being thought the interpreters; whilst in reality he does no more than deliver sophistry, by broken, short and interrupted sentences, so as to prevent a confutation; or else in a haughty manner records such observations as are trite, vulgar, and known to every rustic.*

Celsus, as he is justly allowed, comes nearly up to the views and designs of Hippocrates, which are not so faulty, as they are useless; but he shews himself a more practised sophister, and a better modeller of history than his master. He is, however, for checking the advancement of science, from moral and civil considerations; thus paring off the extremities of errors, instead of cutting them down at the root.†

This free censure of the most eminent men will, doubtless, have a strange appearance to many; and yet, in truth, we produce it not as an inflam-

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* Hippocrates has bore such a high character through several ages, that it is extremely hard to get rid of the prejudice: but let his admirers specify what direct improvements he has made in physic; and whether he cured more patients in proportion, than his predecessors, or those in other countries, who never heard of his name.

† In passing a judgment on Celsus, we must guard against being imposed upon by his style; and consider only his matter: which, perhaps, is little more, or better, at bottom, than that of Hippocrates.

ed or aggravated accusation; but as the real state of the case, representing the very bottom of their writings, which mankind are so fond of, and take for the pillars and fabric of all arts and sciences.*

SECT. II.

THE JUDGMENT TO BE PASSED UPON THE ANCIENT AND MODERN PHILOSOPHERS: WITH THE INTIMATION OF A JUSTER WAY OF BUILDING UP THE SCIENCES.

IT may be alledged, that we have above represented the worst side of antiquity and the philosophers; especially as the sciences generally appear in a state of Democracy;† that time, like a

* As the author has been so free in his censures of the former philosophers, it may very justly provoke a thorough sifting and examination of himself. This we could wish to see done by a hand equal to the work; and such an one as could not be suspected of prejudice, or partiality, for or against him. And were it not also proper, that such a free sifting and manly censuring should be continued down to later authors; in order the better to examine how far the sciences are improved.

† And are therefore not to be judged of by the laws of Aristocracy, as the author may seem to have done by censuring the heads, or most capital philosophers of antiquity; instead of the sciences themselves, dispersed among the body of mankind.

river, has brought down to us only such wrecks of former ages as were light, and superficial; but sunk all that were solid and ponderous: that great things have been done by those ancient enquirers after truth, Heraclitus, Democritus, Pythagoras, Anaxagoras, Empedocles, and others, whose writings are lost; and that the silence and knowledge of antiquity are not to be lightly esteemed. To all which we will here answer, in our natural manner, candidly, and with a view to the good of mankind.*

And first, I acknowledge a fragment or two of early antiquity; by which I do not mean books, but inventions; that are, however, rather a specimen of the author's diligence and ingenuity, than deep knowledge, in respect of philosophy and the sciences; and handed down to us by other writers. But for those things which have never come down to us, nor any traces of them, it were an endless labour to make conjectures about them. Nor can I think it at all proper for me, who am engaged in doing the utmost service I am able for posterity, to go back to the philology or polite literature of the ancients. But in order to give mankind a view of the pro-

* For a thorough expurgation, it may be proper to peruse the whole de Augmentis Scientiarum, and Novum Organum.

phetical Janus-face of the present state of things, and how it looks both back upon times past, and forward upon times to come; I have determined within myself to form tables of both these times; which may not only exhibit the course, and the ebbs and flows of knowledge; but likewise other apprehensions and foresights of things. Nor, perhaps, can the world have a notion, what kind of performance this will be, till they see it; or, were it not to be put into their hands, know how to ask for, or expect it; as they are now bound and enthralled.* For this we lay down as a certainty, that knowledge is not to be fetched from the darkness and obscurity of antiquity; but to be derived from the light of nature. Nor does it so much concern us to know what has been done, as to see what may be done. Would a private man, put in possession of a kingdom, subdued by arms, and right of conquest, raise questions and disputes, whether his ancestors possessed it before him; and perplex himself with rumours of genealogies and descents; or

* The work here mentioned, though, perhaps, never executed, in the form of tables; at least, never published by the author; may very well have been conceived in his mind: and whoever desires to have some perception of the thing, may, with due attention, derive it from the author's pieces de Augmentis, the Sapientia Veterum, the Novum Organum, and the Phenomena of the Universe.

would he not rather secure his possession, and establish his dominion?

And whoever considers the matter closely, will not find it strange, that the above-censured heads of sects, and numberless others, of the same kind, should fall into errors, which are various and endless; whereas truth is but one simple single thing. And had not the policy or foresight of times been opposite to such wild wanderings of the human genius, no doubt but many other coasts of errors would have been rambled over: for it is an immense ocean that surrounds the island of truth; and there still remain many pernicious idols, of late invention, to be thrown down.* Thus Telesius lately trod the stage, and acted a new philosophical romance; without any great elegance or applause. And to this day the motions of the heavens are, by fabulous astronomers, perplexed with eccentrics and epicycles; and the stability and mobility of the earth are strenuously pleaded for on both sides, from the uncertain attestation of phenomena. And this is the general case of theories, in which men usually proceed, as he would do, who understanding no language but his own, should undertake to interpret a book in another; where observing that a few words up and down

* See the Novum Organum, Part I. Sect. II.

corresponded, in sound and letters, to the words of his own language, he immediately asserts, with confidence and assurance, these words to be of the like signification, (though they might frequently differ very widely) and thence, by farther comparison, with great labour and trial of wit, and, at the same time, with great licentiousness, divines the sense and meaning of the whole. And just such interpreters, philosophers generally are, of the sense and meaning of nature, in the grand volume of the universe; for every one brings his own particular idol, as it were his mother-tongue, to the history of nature; and as soon as he finds any thing sound like it, this he eagerly catches at, and interprets every thing else analogous thereto.*

It is now time we should expatiate ourselves, after handling such prophane and polluted matters; though it has been only with a desire of improving. And we here declare, that all the charges we have brought against the philosophers, fall far short of their guilt: though we do not expect the generality should understand in what manner we have convicted them. But they may be assured, that the censures passed upon them

* This is properly a species of philosophical madness. See above, Sect. I. II. and the Introduction to the Novum Organum.

have not the least participation of calumny or scandal: for I have not here, like Velleius in Cicero, acted the declamer, who lightly touched upon opinions, and then threw them aside, without entering into their merits; much less, done like our modern Agrippa, who, indeed, deserves not to be mentioned in a discourse of this nature; as being a trifling scoffer, that aims to wrest and make sport with every thing:* but whoever looks intently, and is qualified to see it, will find that, under the veil of a feigned severity, there are just and stinging accusations couched, contracted to a little compass, and, not without some address, thrown directly into the ulcers of the mischief. And though they all seem involved and embroiled together in the same crimes and guilt; yet I have accused each of them with that only which is peculiar to himself, and of a capital nature. For the human mind, swoln with the incursions and observations of things, works up, and draws out of them, errors of various shapes and forms: so that Aristotle, for example, appears like a tall plant, of a particular species; Plato, as another of a different kind; and so of the rest.

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* I suppose the author has his eye more immediately upon that piece of Agrippa, entitled de Vanitate Scientiarum; a title as different from his own de Augmentis Scientiarum, as the two persons, and their abilities.

But for me to enter into particular confutations of their several works, would be a heinous offence, an injury to the fortunes of mankind, and consume the time, destined to their service, in a conflict with shadows; which may vanish of themselves. Indeed, the only thing required, is to set up the bright and shining light of truth; which may illuminate all the things around it; and in a moment disperse all the errors and darkness with which mankind are beset:* for it would be endless to carry weak and sickly tapers about into all the sculking holes and corners of particular errors and falsehoods.

But notwithstanding what we have said, it must not be supposed, that all which the philosophers above-mentioned have delivered, is perfectly vain and false: for there is no one of them but has sometimes stumbled upon a truth; and indeed their errors seem rather owing to their great unhappiness, than to their ignorance. When Heraclitus declared, that men ought to seek for knowledge, not in the private world of themselves, but in the common external world,

* This was the design of the Novum Organum; which the author had once entitled, Aphorismi & Consilia, de Auxiliis Mentis, & Accensione Luminis Naturalis. But as that work was left imperfect, we have only some portion of this grand light held out to us.

he seems to have laid a just foundation for philosophy. When Democritus attributed immense variety, and infinite succession to nature, he ran counter to nearly all the other philosophers; who absolutely went down with the stream of their times; enslaved to custom: and by this opposition he destroyed both falsehoods, dashing them one against the other; and thus opening a way to truth betwixt the two extremes, he happily shewed himself a philosopher. The numbers of Pythagoras, likewise promised some good event. Diudamus the Indian spoke well, when he called death by the name of nature's enemy. Epicurus also is tolerable; though he disputes but weakly, and with philological arguments, against the explanation of intentional and final causes. Even the sceptical Pyrrho, and the fluctuating academics (though confined to scanty bounds, and behaving themselves to their idols like peevish lovers, that are always quarrelling, but never part) may be read in the way of recreation; for whilst others are made to drag their anchors, by their idols; the academics are only whirled round in their cock-boat. Nay, Paracelsus and Severinus make excellent heralds; and sound the alarm to experiments.

But shall we say that these men were in possession of truth? they were certainly far from it. It is a good homely proverb: that a hog, though

by rooting the ground he may make the first letter of the alphabet, yet cannot write a play. For the truth discovered by analogy of knowledge, is widely different from that delivered by the start of an idol: the former is regular, constant and manifold, whilst the other is incongruous, unsteady and single; and the case is the same in works. Thus the discovery of gun-powder, had it not been accidental, and a sudden start, but the effect of reasoning, would not have been single; but accompanied with a number of other noble inventions, which fall under the same meridian. Understand the like of other works and positions.* I would therefore require, if any one's idol should in any point intersect the truth of the things I have here laid down, that he be not hence conceived the better, nor I the worse of; as it is manifest this difference must proceed from ignorance, and not from any analogy of knowledge.†

After all, we hope no one will conceive our intention is to condemn the writings of the ancient and modern philosophers to the flames,‡ or the

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* See this prosecuted in the first part of the Novum Organum.

† This will not be understood, unless the doctrine of idols, delivered in the Novum Organum, be mastered.

‡ As Mr. Hobbs is said to have done.

service of the grocer. They have still some use; though, indeed, but little, and of narrow extent; very different from that they were designed for, and are at present employed in. To this we may add, that many other writings, of less fame and note, are much more useful than those of the philosophers. The ethics of Aristotle and Plato have found numerous admirers; but the moral observations of Tacitus express nature more to the life. But for the particular uses to be made of these writings; which of them are more serviceable than others; and how small a part of them conduce to the interpretation of nature, we may shew in due time.*

It may here be asked, will the author pretend himself alone to supply the place of all the philosophers he thus censures and rejects? he answers candidly, and without dissimulation, that his sole view is to join mankind and things together, in a sacred, legitimate and inviolable link; that from this conjunction may proceed a happy race of heroes, to subdue the infinite necessities of human nature; and settle their whole affairs in a plentiful, peaceful and happy security.†

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* See the Novum Organum, Part i. passim.

† Some readers may be at a loss to know what the author drives at in this piece; or in what sense to understand him; unless they have been conversant in the rest of his writings.

The point of view is this; that the ancient and modern philosophers, taken in a body, have miserably mispent their time, and abused their talents; without once entering into the high road of truth, or the way of making the proper discoveries, for improving the arts and sciences, that might greatly benefit human life. This every one may satisfy himself of, by examining what has been done by Plato, Aristotle, Hippocrates, &c. towards discovering the art of inventing arts; or making life more happy and agreeable. For who among them has taught the art of prolonging life, or spinning the full thread thereof to its natural period, free from diseases, pain and sickness; so far, we mean, as the condition of mortality permits? Who has shewn the way of curing inveterate diseases, as the stone, the gout, &c.? Who has taught us to secure our habitations from fire, inundations, earthquakes; our ships from storms, and perishing at sea? Who has taught us to predict the weather, or given us the least command of it? Who has shewn us a way to supply parched countries with water, where natural springs are denied? Who has shewn us a practical way of governing our appetites, and correcting our vices; so as to prevent that train of ills which attend tyranny, oppression, superstition, and false religions? Numerous instances of this kind might be mentioned, all tending to the accommodation of life; which philosophers, as they are called, seem to have overlooked, or despaired of. But these were the things that employed our author's thoughts; and a method of procuring remedies for all human evils seems to have been the one capital thing he aimed at.

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